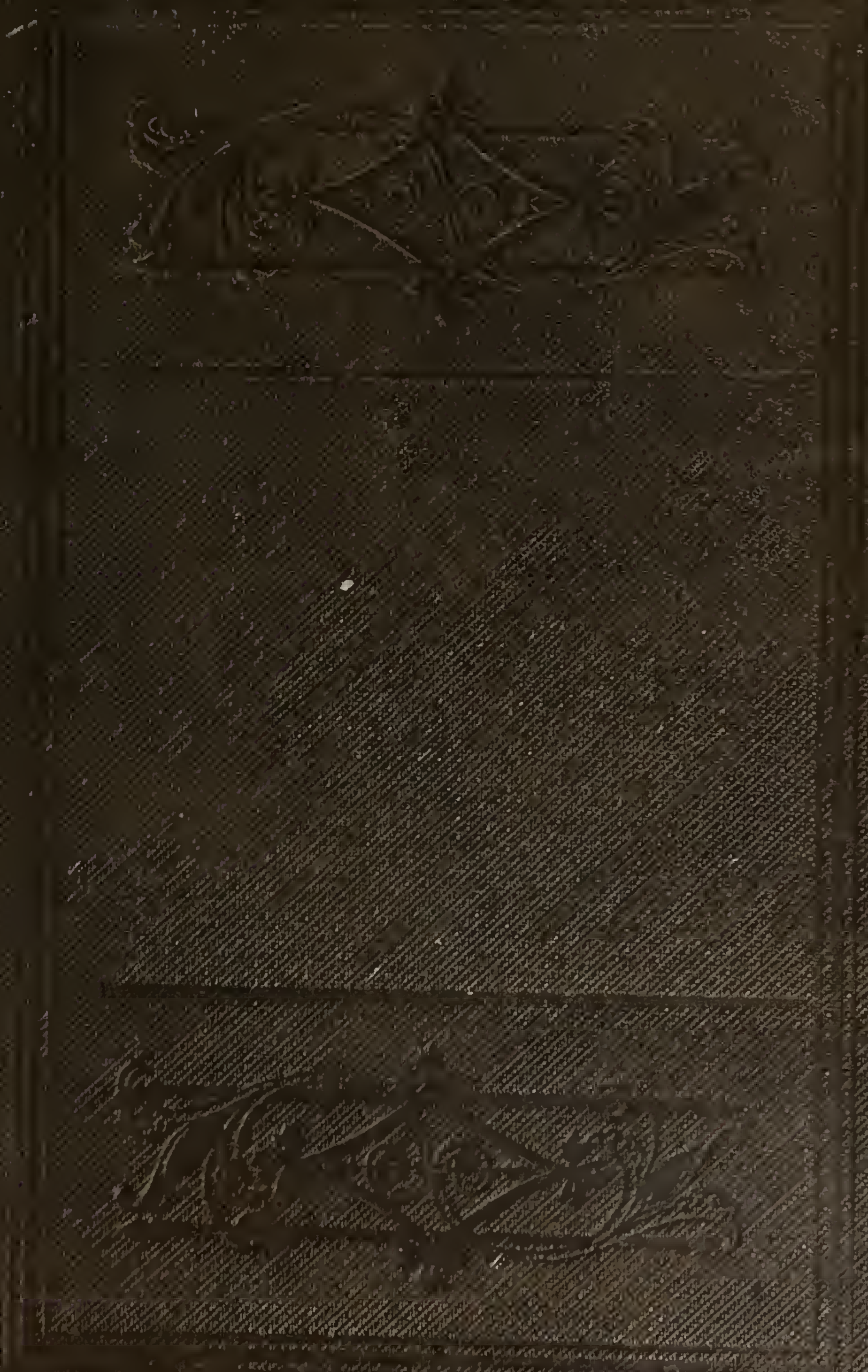

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THE

PRACTICE

OF

SURGERY

A MANUAL

BY

THOMAS BRYANT, F.R.C.S.

SURGEON TO, AND LECTURER ON SURGERY AT, GUY'S HOSPITAL

WITH FIVE HUNDRED AND FIFTY-NINE ILLUSTRATIONS

Second Edition, Revised and Enlarged

VOL. I

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PREFACE.

A SECOND EDITION of this manual having been called for, I have availed myself of the opportunity to make some alterations in the substance as well as in the arrangement of the work, and, with a view to its improvement, have recast the materials and revised the whole. I have, also, to make the work more complete, added much new matter, including chapters on diseases and injuries of the eye and ear, some remarks on dental surgery, on the diagnosis of ovarian tumours, and on deformities, together with at least one hundred new woodcuts.

The book has also, for the sake of greater convenience, been divided into two volumes, the first including the elementary principles of our art, general subjects, tumours, the surgery of the cutaneous, lymphatic, nervous, circulatory, and digestive systems; and the second the surgery of the respiratory, urino-genital, muscular, and osseous systems, with a full general index.

I am well aware that I have failed to realise, in the execution of my task, the ideal standard I, at starting, proposed to myself, and I knew when I first undertook to write the book how difficult it was to compress the treatment of the vast range of subjects included under the title of Surgery into one volume; but my object was to offer such an epitome of the main principles and methods of practice as should be serviceable to the student and practitioner; and from the reception the first edition of this work, published in November, 1872, has met with in Great Britain and America, I feel justified in saying that I have not failed in the attempt, and that the book supplied a want felt by the professional public.

I readily acknowledge that the former edition of this work contained many faults, both literal and of composition, which my "candid friends," with proverbial energy, were not slow to point out; but I owe them no ill will for this gratuitous act, although I should have preferred to have avoided such errors, if only, to have deprived one nameless critic of an excuse for a display of feeling which, to say the least, was neither just nor generous.

I have, however, endeavoured, in this edition, to remove all such blemishes as gave offence, and at the same time must frankly confess that my interests are more deeply concerned in dealing with disease and its treatment than in punctuation and printer's errors; well knowing, moreover, how impossible it is to satisfy all critics, particularly those who, as Byron said, "themselves are sore."

To the many reviewers, who have acknowledged my labours so fairly and so fully, my thanks are clearly due, but still more to the profession which has welcomed my humble services so kindly.

Fully alive, therefore, to the generous appreciation of my past work, and assuring my readers thatno pains have been spared to bring the present up to as high a standard as my time and opportunities have allowed, I submit it in all confidence to the kind consideration of my professional brethren as no unworthy exposition of modern British Surgery.

In its execution I have endeavoured to acknowledge on all occasions the claims of others, and whatever merit or novelty may attach to their views or operations, for my wish has been to represent not so much my own opinion as the position of Surgery at the time I write.

It only remains for me to express once more my obligations, to Mr. Thomas Turner, the Treasurer of Guy's Hospital, by whose kindness the materials in the unrivalled collections of that institution were placed at my disposal; to my colleagues, Drs. Moxon, Goodhart, and Purves, Messrs. Howse, C. Higgens, and Moon; and to Mr. Wesley, the artist who has so ably illustrated these pages.

Since I first undertook this work death has deprived me of two colleagues, Mr. Poland and Dr. Phillips, both of whom rendered me many friendly services and much valuable assistance. I refer to their names with gratitude and regret.

53, Upper Brook Street,
Grosvenor Square;
March, 1876.

VOLUME FIRST.

CONTENTS WITH LIST OF ILLUSTRATIONS.

INTRODUCTORY CHAPTER.

page
How to Investigate a Case—Diathesis—Cachexia, &c. . 1

CHAPTER I.

On Repair—Inflammation—Abscess—Ulcers—Bedsores—Mortification—Erysipelas—Septicæmia and Hectic 9

Fig. *page*
1. Diagram illustrating the process of repair . . 13
2. Pus-corpuscles . . 18
3. Abscess knife . . . 21

CHAPTER II.

Animal Poisons—Poisoned Wounds—Serpent Bites—Hydrophobia—Glanders and Syphilis 66

4. Anatomical tubercle . 68
5. Syphilitic deposit in testicle 82
6. Hereditary syphilis . 88
7. Syphilitic teeth . . 89
8. Healthy teeth . . 89

CHAPTER III.

Tumours, with their Microscopical Anatomy . . 93

9. Serous cyst of neck . 101
10. Sebaceous tumours in scalp, and horn . . 105
11. Fungating follicular tumour 106
12. Fatty tumour . . . 107
13. Fibrous tumour . . 110
14. Enchondromatous tumour 111
15. Adenoid tumour . . 113
16. Cancer of bone . . 121
17. Melanotic cancer . . 122
18. Cancer of stump . . 123
19. Rodent cancer . . 124
20. Colloid tumour of breast, with section . . . 125
21. Microscopical anatomy of osteoma, enchondroma . 135
22. Ditto, sarcoma . . 136
23. Ditto, myxoma . . 137
24. Ditto, adenoma . . 138
25. Ditto, carcinoma . . 139
26. Ditto, lymphoma . . 141

SURGERY OF THE CUTANEOUS SYSTEM.

CHAPTER IV.

page

Contusions—Wounds—Burns and Scalds—Cicatrices—Skin Grafting—Chilblains—Frostbite—Boils and Carbuncles—Moles—Bunions—Affections of Nails—Elephantiasis Arabum—Parasites . . 142

Fig. *page*
27. Interrupted suture . . 145
28. Continued suture . . 146
29. Twisted suture . . 146
30, 31. Quilled suture . . 147
32. Rib pierced by arrow . 149
33. Axillary cicatrix after burn 156
34. Mode of applying extension after its division . 156
35. Effects of burn on neck . 157
36. Cheloid of Alibert . . 159
37. Cheloid of Addison . . 159
38. Scissors for skin grafting 161
39, 40. Drawings illustrating the cicatrization of sores by skin grafting . . 162

Fig.
41, 42. Drawings illustrating growth of black skin when grafted on sore of white man . . . 163
43. Ingrown toe-nail . . 177
44. Acute onychia . . 178
45. Chronic onychia . . 178
46. Horny growth beneath nail 179
47. Ungual exostosis . . 179
48. Elephantiasis Arabum before operation . . 180
48A. Ditto, after . . . 180
49. Guinea-worm bleb . . 182

SURGERY OF THE LYMPHATIC SYSTEM.

CHAPTER V.

Inflammation of Lymphatics—Hodgkin's Disease of Glands—Diseases of Thyroid Gland 184

50. Exophthalmic goitre . 190
51. Pedunculated thyroidal tumour . . . 193
52. Microscopical appearance of thyroid glands . . 193

SURGERY OF THE NERVOUS SYSTEM.

CHAPTER VI.

Injuries of the Head.—Contusions and Wounds of Scalp—Ostitis—Fractures—Concussion—Compression—Wounds of Brain—Inflammation of Brain—Trephining—Disease of Scalp and Cranium—Tetanus—Delirium Tremens—Shock and Collapse—Feigned and Hysterical Disease 195

53. Gutter-shaped fracture of skull 200
54. Saucer-shaped ditto . 200
55. Comminuted fracture of skull with depression of inner table . . . 200
56. Fracture of base of skull . 202
57. Fracture of anterior fossa of the base of the skull 206
58. Punctured wound of skull 206
59. Extravasation of blood between bone and dura mater 214
60. Operation of trephining . 229

CHAPTER VI—*Continued.*

Fig. *page*
61. Trephining instruments . 229
62. Meningocele at root of nose 237
63. Encephalocele . . . 237
64. Necrosis of frontal bone . 239

CHAPTER VII.

Injuries and Diseases of the Spine.—Spina Bifida—Congenital Sacral Tumours—Concussion—Intra-spinal Inflammation—Spinal Paralysis—Fractures and Dislocations—Wounds and Sprains—Curvature of Spine—Injuries and Diseases of Nerves—Neuralgia—Neuroma 254

65. Dissection of spina bifida. 255
66. Double spina bifida . 256
67. Cured spina bifida . . 257
68, 68A. Congenital coccygeal tumours . . . 259
69. Dislocation of spine . 267
70. Fracture of spine . . 268
71, 72. Lateral curvature of spine 275
73, 74. Angular curvature of spine 277
75, 76, 77. Disease of cervical vertebræ . . . 279

CHAPTER VIII.

Diseases and Injuries of the Eyelids and Eye, with Operations on Eyeball and its Appendages—Affections of the Orbit 286

78. Liebreich's ophthalmoscope 289
79. Indirect ophthalmoscopic examination . . . 290
80. Accommodation and refraction . . . 295
81. Oldham's ophthalmoscope 296
82. Position of patient for minor operations . . 330
83. Position for major operations 330
84. Compressorium forceps . 334
85. Ditto, applied . . . 334
86. Wire speculum . . 337
87. Grooved director for slitting canaliculus . . 339
88. Instruments for operations for strabismus . 344
89. Instruments for iridectomy 349
90. Wecker's scissors . . 353
91. Artificial pupils . . 353
92. Instruments for extraction of cataract . . . 357
93. Incisions for extraction of cataract . . . 357
94. Instruments for removal of cataract with scoop . 360
95. Extirpation scissors . 364

CHAPTER IX.

Affections of the Ear, External and Internal . . 375

96. Politzer's method of examining middle ear . 375
97. Effects of injury on ear . 376
98. Cheloid tumour of ear . 377
98A. Microscopical appearances of same . . 377
99. Hæmatoma auris . . 378
100. Syringing ear . . 381
101. Appearance of membrana tympani . . . 388

SURGERY OF THE CIRCULATORY SYSTEM.

CHAPTER X.

page
Wounds of the Heart and Arteries—Hæmorrhage and its Treatment—Diseases of Arteries—Embolism—Aneurism and its Treatment—Nævus—The Ligature of Arteries—Special Aneurisms . . . 397

Fig. *page*
102. Effects of natural hæmostatics 400
103. Effects of ligature on an artery 401
104. Effects of torsion on artery 401
105. Drawing showing application of ligature to artery, tourniquet, torsion forceps, &c. . . . 406
106. Different modes of acupressure . . . 408
107. Effects of torsion on artery 409
108. Inflammatory change in artery that precedes atheroma . . . 416
109. Atheroma of artery . . 416
110. Sacculated traumatic aneurism 419
111. Multiple aneurisms . . 419
112. Laminated clot from aneurism 420
113. Section through cured aneurism . . . 421
114. Mode of applying pressure to femoral artery for the cure of aneurism 426
115. Weiss's double pad for pressure . . . 427
116. Mr. G. Coles' pad for elastic pressure . . . 428
117. Diagrams showing the different operations for aneurism . . . 430
118, 119. Drawings illustrating the collateral circulation in the lower extremity after the application of a ligature to the external iliac artery . . . 437

Fig.
120. Different forms of arterio-venous aneurisms . . 438
121. Mr. Cock's case of arterio-venous aneurism . . 439
122. Degenerating nævus . 442
123. Mode of ligaturing nævus 443
124. Effects of nævus of upper lip 444
125, 126. Modes of ligaturing large nævi . . . 444
127. Needle for the application of a subcutaneous ligature to a nævus . . 445
128. Diagram illustrating the application of a ligature to an artery . . . 447
129. Best form of aneurism needle 447
130. Incision for the application of a ligature to aorta or common iliac artery . 449
131. Operation for ligaturing common carotid and facial arteries . . . 453
132. Operation for ligaturing the subclavian and lingual arteries . . 458
133. Ligature of axillary artery 459
134, 135. Ligature of brachial artery 460
136. Ligature of radial (upper third) artery . . 461
137. Ligature of radial and ulnar arteries . . . 462
138. Ligature of external iliac and femoral arteries . 464
139. Ligature of posterior tibial artery 468
140. Ditto behind malleolus . 469
141. Ligature of anterior tibial artery 470
142. Ligature of dorsalis pedis 470

CHAPTER XI.

page
Injuries and Diseases of the Veins—Operations on Veins. . 471

Fig. page
143. Drawing illustrating case in which the inferior vena cava was obstructed 477
Fig.
144. Varicose veins . . 479
145, 146. Venesection . . 483

SURGERY OF THE DIGESTIVE SYSTEM.

CHAPTER XII.

Affections of Lips, Mouth, Tongue, Palate and Tonsil . 485

147. Drawing illustrating formation of upper jaw . 485
148. Central fissure of lip . 486
149, 150, 150A. Drawings illustrating degrees of single harelip 486
151, 152. Drawings illustrating double harelip . . 486
153. Position of patient for operation of harelip . 487
154. Operation for single harelip 488
155. Hainsby's truss for harelip 488
156, 157. Collis's operation for harelip 489
158. Malgaigne's operation . 489
159, 160. Operation for double harelip 489
161, 162, 163. Ditto with projecting intermaxillary bones 490
164, 165, 166. Drawings illustrating cheiloplastic operations for deformed mouth 490
167. Cancer of lower lip . 491
168, 169. Drawings illustrating operation for formation of new lip . . 492
170. Hypertrophy of mucous glands of lip . . 493
171. Cancrum oris . . . 494
172. Ranula or sublingual cyst 495
173. Salivary calculus . . 496
174. Submaxillary tumour . 498
175. Tongue forceps . . 502
176. Figures illustrating operation for the removal of tongue 502
177. Diagram illustrating different operations for removal of tongue . . 503
178. T. Smith's gag. . . 505
179. Furgusson's knives for operations on palate . 505
180. Figure illustrating the paring of the edges of fissured palate after introduction of sutures . 506
181. Needles employed in fissured palate. . . 506
181A. Scissors for ditto . . 507
182, 183. Drawings illustrating operation for fissured palate 508
184, 185. Drawings illustrating Fergusson's operation on hard palate . 509
186. Trendelenburg's tracheal tampon . . . 511
187. Tonsil guillotine and mode of application . . 513
187A. Removal of tonsil with knife 513

CHAPTER XIII.

page
Diseases of Gums, Jaws, Teeth, Pharynx and Œsophagus . 515

Fig. *page*
188. Fibrous epulis from gum 515
189. Epulis springing from bone 515
190. Tooth odontome . . 515
191. Odontome after removal . 516
191A. Ditto in section . . 516
192. Necrosis of lower jaw with condyloid process . . 518
193, 193A. Dentigerous cyst of upper jaw with tooth . 521
194. Ditto lower jaw . . 521
195. Dentigerous tumour of upper jaw . . . 522
196, 197. Enchondromatous tumour of upper jaw . 523
198, 199. Drawings illustrating lines of incision for removal of upper jaw . 524
200. Saw for operation on jaw 524
201. Lion forceps for ditto . 524
202. Periosteal sarcoma of lower jaw . . . 525
203. Fibro-cellular tumour of lower jaw . . . 525
204, 205. Fibro-cystic disease of lower jaw . . 526
206. Dislocation of lower jaw . 529
207. Reduction of dislocation of lower jaw . . 530
208, 209. Bandage and splint for fracture of lower jaw 532
210. Thomas's mode of adjusting fracture of lower jaw 532
211. Moon's interdental splint 533
211A. Metal caps for ditto . 533

Fig.
212. Hammond's wire splint for fracture of jaw . 534
212A. Hammond's wire splint applied to ditto . . 534
213. Vertical section of tooth . 535
214. Diagram of developing lower molar tooth . 536
214A. Malformed syphilitic teeth 541
214B. Healthy teeth . . 541
215. Drawing of child's jaws showing the development of the permanent teeth 544
216. Mouth mirror and searcher for the examination of teeth 554
217. A series of drawings illustrating the progress of decay in teeth . . 556
218A. Rhizodontropy . . 557
218B. Drawing illustrating pivoting with vent . . 557
219. Manner of holding tooth forceps . . . 564
220. Stump forceps . . 564
221. Scoop elevators . . 564
222. Revolving pharyngeal forceps for removal of foreign bodies . . . 570
223. Impacted pudding in œsophagus 571
224. Horsehair probang for extraction of foreign bodies in œsophagus . 571
225. Money probang, with sponge 572

CHAPTER XIV.

Injuries of the Abdomen and its Contents . . 573

226. Diagram showing position of abdominal viscera . 585
227. Mode of applying sutures to wound of intestine . 586
228. Piece of iron wire discharged through abdominal walls after having been swallowed . . 590

CHAPTER XV.

page
Abdominal Hernia 601

Fig. *page*
229. Nine diagrams illustrating the different forms of hernia . . . 601
230. Oblique inguinal hernia . 606
231. Direct inguinal hernia . 606
232. Femoral hernia . . 606
233. Drawings illustrating effects of strangulation of the bowel . . . 613
234. Stricture of bowel, result of strangulated hernia . 615
235. Key's operation for hernia 622
236. Drawing illustrating the relative position of the abdominal rings from within 622
237. Hernia knives . . . 623
238. Spica bandage . . 625
239A, 239B. Drawings illustrating the second form of displaced hernia . . 628
240. Drawing illustrating the intra-parietal (fourth) form of displaced hernia 630
241. Wood's operation for radical cure . . . 637

CHAPTER XVI.

Surgery of the Anus and Rectum . . . 648

242. Rectum ending in cul-de-sac above anus . . 649
243. Enormously distended rectum in man after operation for imperforate rectum in infancy . . 651
244. Speculum for examination of rectum . . . 656
245. Operation for anal fistula 661
246. Internal hæmorrhoids . 663
247, 248. Forceps for hæmorrhoids 667
249. Clamp for hæmorrhoids . 668
250. Prolapsus recti . . 670
251. Villous polypus of rectum 672
252. Microscopical drawing of ditto 673
253. Cancerous stricture of rectum 677
254. Artificial anus after colotomy 682

RADFORD

THE

PRACTICE OF SURGERY.

INTRODUCTORY CHAPTER.

The science of surgery is the knowledge of the character and causes of disease, and of the processes by which the effects of disease and injury are repaired. The art of surgery is the method of dealing with such diseases or injuries as present themselves. The art, to be applied with success, must be based upon the science, and the science, to be acquired with certainty, must be based on observation. At the bedside the phenomena of disease are to be studied, its symptoms recognised and duly weighed, and in the post-mortem room the effects of disease are to be traced. The first object of the student should consequently be the habit of clinical and pathological investigation, the study of the living and the dead, for it is by such alone he may hope to acquire a solid basis on which to ground his practice. The external features of a local disease may be the same to the eye of the student and the most accomplished surgeon; but phenomena of disease will be visible to the educated eye which the uneducated would fail to observe; the unconscious influence of experience giving to the mind of the one a power of recognition and interpretation which is denied to the other. It is to the acquisition of this power, therefore, that the student should bend his energies, and in consonance with these views, by way of introduction I propose briefly to consider by what method a correct opinion is to be obtained in any given instance; how sources of fallacy are best eliminated and a correct diagnosis is to be established; for it cannot be too forcibly impressed upon a student's mind that the treatment of a case cannot be successful unless based on a clear understanding of its wants, and that these can never be duly appreciated where a correct diagnosis of its nature has not been made.

Skilled and unskilled observation.

On diagnosis.

The mind of the surgeon should be judicial, it should possess nothing of the advocate, it should be so regulated as to be able to put aside all prejudices and preconceived ideas; to suppress the advocacy of all unsupported theories and hypotheses; to accept clinical phenomena as they are observed, and come to a conclusion cautiously and clearly after a due balancing of the facts of the case, and a careful weighing of the possibilities and probabilities of its nature.

Its principle.

To form a diagnosis of a case mainly on probabilities as indicated by

5

its symptoms may be a ready, but it will ever be a rash proceeding. To form it on the possibilities will always be a safe, although, perhaps, a less expeditious practice. A surgeon who acts upon the first method must, at times, fall into grave errors, although his diagnosis will often appear brilliant and successful; but he who habitually frames an opinion after taking into consideration every possibility of the case he has before him, and comes to a conclusion by a process of exclusion, must surely, on the whole, be more certain in his ends, as he will be a safer and sounder practitioner.

I would therefore lay down the following conclusion as a guiding principle of investigation for the student to adopt, it being alike applicable to all cases of injury as well as of disease:

Reasoning by exclusion.

That in the diagnosis of a case every possibility of its nature should be entertained, and a conclusion arrived at by a process of elimination; each possibility should be separately considered and weighed, and the most probable finally accepted; a diagnosis wholly framed on probabilities being most hazardous.

Example.

For example, a tumour at the femoral ring may *possibly* be an abscess, a varix, an aneurism, a cyst, a hernia, an enlarged gland, or a new growth. An abdominal tumour may be ovarian, uterine, peritoneal, vesical, splenic, renal or hydatid. Its probable nature will be best arrived at by eliminating each of these possibilities *seriatim*, after a due consideration of all its clinical symptoms: the most probable diagnosis being finally accepted on evidence both negative and positive.

How to diagnose.

With the above great principle of practice as a guide in clinical investigation, I will now proceed to consider how any case of injury or disease is to be interrogated; confining my observations to classes of disease. I do not propose, however, to point out to the student the exact mode in which it is well to examine a case or to report it—for the latter is only a written examination—although I would remind him that at pages 7 and 8 an outline will be seen, which will probably be found of use in aiding him in his task. I drew it out many years ago when surgicial registrar at Guy's, where it has been generally followed ever since.

How to Investigate a Case.

When a surgeon is called to a patient, his questions naturally apply first of all to the seat of disease or injury. Is it in the head, chest, abdomen, or extremities? He next asks as to its duration; When was the injury received? When was the disease discovered? If a case of injury, his inquiries would tend to elicit the exact mode of its production, the force employed, and the character of the instrument by which it was produced; for these points are of essential importance under all circumstances, and in head injuries they often give the key to the solution of many questions. By these means the exact seat of injury will probably be indicated, and the surgeon will be led to make a close examination of the injured part; but he should never fail to assure himself that all other parts of the body are sound and in working order, that no other part is involved in disease, or is the subject of injury; for it would be a forlorn hope to amputate for a crushed limb when associated with a ruptured liver, or to reduce a dislocated joint when combined with some fatal internal lesion.

Example, brain injury.

In a case of injury to or disease of the head or nervous system, the most important point a surgeon has to determine has reference to the exact seat of the affection. Is it confined to the soft parts covering the bone, or are the contents of the skull in any way involved? For in the former case, the affection is comparatively of small importance; while in the latter, its gravity cannot be too highly estimated. Scalp wounds, however severe, have as a rule a successful ending; whilst brain injuries, however trivial, should always be regarded with apprehension, for they may lead to the most serious complications.

When no signs of brain disturbance after an injury have been observed the diagnosis is not difficult, for without symptoms, local or general, a surgeon may be excused from entertaining the idea of brain complication. But when indications of brain disturbance exist, the difficulty arises, for it cannot be too firmly impressed on the student's mind that the same symptoms may be produced by concussion as by compression of the brain; and that depressed bone pressing on the brain, and blood effused upon its surface, or within its structure, give rise to precisely the same phenomena; he should know that the symptoms produced by apoplexy the result of a ruptured vessel, and by hæmorrhage into the brain from an injury, are almost identical, and that those produced by what is called functional disturbance of the brain closely resemble those caused by organic mischief. Whilst, therefore, it is imperative for the student of surgery to remember that a variety of different conditions may give rise to apparently identical clinical symptoms; he must know that the clinical *history* of each of these cases will, on inquiry, be found to differ widely, and that it is to the collateral evidence of the case he must look to find the right clue to a successful diagnosis.

Value of clinical history.

Where no clinical history can be obtained the difficulties of diagnosis are indeed great: for example, when the surgeon is called to see a man who has been picked up in the street, and is insensible; who is, in fact, in an apoplectic condition, and has, at the same time, some external evidence of injury to his skull; and who may perhaps, also smell of spirits. The questions that arise in the surgeon's mind under these circumstances are very conflicting. Did this man have a fit and then fall? or are the symptoms due to a brain injury, the result of an accident? Was he knocked down and injured, or did he fall? Are the symptoms caused by drunkenness, or how far are they complicated with it? Are they the result of blood-poisoning from kidney disease or poisoning by opium?

To unravel all these points, great care and discrimination are required. Too much cannot be bestowed upon the task, for to treat an apoplectic seizure, or a case of severe brain injury from external violence, for drunkenness, is a grave error; and it would be well if I could add that it is never committed. To mistake drunkenness for apoplexy or severe head injury is, perhaps, a less grave fault, although it is, without doubt, a serious one. As a point of practice, however, it is probably a wise rule to regard all these suspicious cases from the more serious point of view, and to watch and wait for symptoms to indicate the practice that should be pursued.

What I wish therefore to impress upon the reader is the necessity of bearing in mind that all these different conditions to which I have alluded present to the surgeon many features in common, and that a correct diagnosis can only be arrived at by a process of exclusion.

The possibilities of the case have been suggested. The probabilities can only come out of a rigid inquiry, even into the minutest circumstance that can be obtained.

Example, local paralysis.

In cases of local paralysis the difficulties of diagnosis are very great. Is the cause a *central* one—that is, is it in the brain or cord? or is it *peripheral*—at the termination of the nerves? or is it *local?*

If one of the two former causes be in operation, the history of the case will probably form a true guide to the surgeon; and in the latter case, some local injury to the nerves supplying the part, some tumour or aneurism pressing upon the nerves, will probably be found; or, perchance, it may be a case of lead palsy or infantile paralysis. But under all circumstances a true diagnosis will only be made by eliminating from our consideration the many possible causes and taking the most probable.

Compare sound with affected side.

Again, *Let it be an invariable rule of practice in every case of injury or disease, to compare the sound side of the body with the affected one.* In the diagnosis of a dislocation or fracture, the information gained by the comparison is always of great value, and furnishes often to the experienced eye a true suggestion as to the nature of the accident. In joint disease, also, the practice is of equal importance; any effusion into a joint, or enlargement of the bones being, as a rule, readily detected on making the comparison.

Bedside experience.

The nature of the disease or injury being thus suggested to the mind through the eye, the suggestion remains to be confirmed or corrected by a careful manual examination, by the other clinical symptoms, and by the history of the case; the facts elicited by the sight, by the hand, and by the ear, being made separately available, and the conclusion drawn after a careful balancing of the probabilities and possibilities of the case. The diagnosis will be well established when all these different modes of investigation lead to one conclusion. In surgery as in medicine the student must educate the eye to see and the hand to feel. The task is no simple one; it is, indeed, the most difficult a student has to learn, and he cannot begin it too early in his professional career. Reading will not help him, nor thought aid him; personal experience alone at the bedside will supply the want.

To recognise the existence of a wound, or the deformity of a broken bone, may not be difficult; but to read aright the endless phenomena which a wound presents, and to make out the character or tendency of a fracture, require much experience. To see that a swelling exists in a part is open to the uneducated eye; but to recognise the various aspects that different tumours assume, to make out their form, position, and attachments, to estimate their consistence, to recognise the fluctuation of fluid, whether superficial or deep, and to detect pulsation, require considerable tactile power and much education. What education is also demanded to read the phenomena presented in diseases of the eye or the skin!

"No study of the written observation of others could enable any man to appreciate those endless varieties of the pulse which entirely baffle description, or to distinguish between the warmth of the skin, excited by various accidental causes, and the pungent heat accompanying the first stage of pneumonia, or acquaint him with the shrunk and shrivelled features derived from the long-continued disease of the abdominal viscera—the white and bloated countenance often attendant on changes in the functions or structure of the kidney—the squalid and mottled complexion of the cachexia dependent upon the united effects of mercury and syphilis—the pallid face of hæmorrhage—the waxen hue of amenorrhœa—the dingy whiteness of malignant disease—the vacant lassitude of fever—the purple cheek of pneumonia—the bright flush of phthisis—the contracted features and corrugated brow of tetanus; all which shades of countenance, with many more that might be enumerated, are distinctly recognised by the experienced eye." (Dr. Bright, 'Guy's Hosp. Rep.,' 1836.)

On Diathesis.

The subject of *Diathesis* claims the attention of the surgeon, for its bearing on practical surgery is undoubted. In the *strumous, scrofulous*, and *tuberculous diatheses*, all of which appear to be closely allied, there is, no doubt, a tendency to glandular enlargement, the formation of caseous deposits and a low kind of inflammatory action, whether in the bones, joints, skin, or lungs; but beyond these clinical facts we know nothing. Disease in subjects who have these diatheses is precisely identical in its essential nature with the same disease as found in others who have them not. It may be modified in its course by the diathesis, but it is the same disease. These names have, likewise, no special signification when applied to local disease.

It is important for the surgeon to bear this fact in mind, for there can be little doubt that the expressions strumous disease, and scrofulous disease, have had an injurious influence on the practice of surgery. They have too often led the surgeon (and misled the public) to regard a local affection in a strumous or scrofulous subject as incurable, as depending on some general condition, and not on a local cause. In disease of the joints this evil has been much felt, and should be corrected.

Scrofulous.

The modern investigations of Drs. Sanderson and Fox in our own country, and Dr. Waldenburg[1] abroad, however, tend to show that the *scrofulous* diathesis, in which there is a tendency to inflammation of a low type, gives rise, under some circumstances, to *tuberculosis,* and that local inflammatory affections of a chronic nature are specially prone to be followed by tuberculous disease. The grey granulations or tubercles are apparently derived from some pre-existing inflammation; from the absorption into the blood of the *caseous* or *cheesy* deposits which are supposed to be the residue of an antecedent inflammatory action—whether in the bones, joints, glands, or lungs—and these are subsequently disseminated in the form of miliary tubercle. Niemeyer, indeed, maintains that "the formation of tubercle never takes place unless preceded by pneumonia, terminating in caseous infiltration of the pulmonary tissue." To the surgeon this aspect of matters is of immense importance, for it is clearly his duty, under such circumstances, to hasten the recovery of local suppurative disease as much as possible, and where this cannot be carried out, to remove it. For let it be once shown that local disease has a direct influence in producing constitutional dyscrasia—call it by what name we will—and the necessity of dealing actively with chronic local affections becomes a duty. I have occasionally acted upon this principle with the best results, and in more than one case, in which there was progressive lung mischief associated with a disorganised knee, have found the lung affection speedily subside after amputation. It must likewise be admitted that a local disease in a strumous subject may be as amenable

Connection between local suppurative disease and tubercle.

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[1] 'Die Tuberculose und Scrofulose,' von Dr. L. Waldenburg. Berlin, 1869.

to treatment as it is in a more healthy one. The treatment of the case may indeed require some modification from the fact of its occurring in such a subject, but the principles of practice in both the strumous and the non-strumous are the same, although we know that in the former all diseased action is of a low type, and that there is always a greater tendency to degenerative changes than we find in other subjects. Some pathologists have been bold enough to say that the scrofulous diathesis is the consequence of hereditary syphilis, but evidence is wanting to support this view.

Hæmorrhagic.

The *hæmorrhagic* diathesis, also, is a subject of peculiar interest to the surgeon. It is generally hereditary there can be no doubt, and in some instances it affects several members of a family. It is shown by a peculiar tendency to bleed on the slightest provocation, and by the difficulty there is in arresting hæmorrhage when it has taken place. The surgeon should always have before him the possibility of his patient being a subject of this diathesis; for although it would not prevent the performance of any operation that is essential to save life, it would materially affect the question of operating for any reason of expediency, and tend to modify the practice.

On cachexiæ.

One word also respecting *cachexiæ*.

Do they exist? Is there any definite aspect associated with any definite disease? Is there a cancerous cachexia? I have little hesitation in stating my belief that in practice no such thing can be established, and that a large number of patients suffering from cancer are as healthy looking as any other class, indeed often healthier. There is no doubt that a patient suffering from cancer which, by its discharges or development, is interfering with the important functions of life, and undermining the patient's powers, has an anxious, drawn, bloodless, and waxy look; but so has the subject of any organic disease which interferes with the functions of digestion and assimilation, and particularly so the subject of rectal disease. The patient exhausted by suppuration, by spinal, bone, or joint mischief, the man or woman who from drink, syphilis, or mercury, separately or combined, is gradually being brought down to death's door, all these have a cachexia more or less peculiar according to the organ involved in the disease, and the special character of the patient; but it is merely the cachexia of looking ill. Clinically, I read the meaning of a cachexia as a looking ill, perhaps very ill, but it has no other definite signification—looking ill from cancer, looking ill from abdominal, rectal, suppurative, or syphilitic disease.

POINTS FOR OBSERVATION IN SURGICAL CASES.

Disease or Injury. Date when seen. Result.

NAME, age, occupation, residence, general health, habits, and aspect. In some cases hereditary history.

HISTORY OF PRESENT DISEASE OR INJURY.—Its assigned cause, or method of production.

ORDER OF SUCCESSION OF SYMPTOMS, with their former treatment, and date of any marked change in either symptoms or treatment.

PRESENT CONDITION AND APPEARANCES; passing in review, and noting when irregular the condition of intellect, senses, and nervous system. Organs of respiration and circulation; Pulse—frequency, force, volume, compressibility, distinctness and rhythm. Digestive Organs,—tongue, appetite, bowels. Urino-genital Organs,—urine, catamenia. Integuments,—eruptions, moist or dry, above or below natural heat. Locomotive Organs,—bones, joints, and muscles, whether paralysed or in undue action.

PREVIOUS DISEASES OR INJURIES, with their dates. Treatment.

PROGRESS OF THE CASE.—Note carefully any change in the old, or the appearance of new symptoms, with the date of change, and treatment, by medicine, diet, &c. &c. Carefully fill in the result, and date of departure; if unfavorable, the condition on post-mortem examination.

NOTE.—As the value of a Report depends upon its conciseness, together with the accuracy and number of recorded observations, it is unnecessary to write one, unless an appreciable change in the symptoms exists.

SPECIAL POINTS FOR OBSERVATION.

HERNIA.—Variety and character,—its position, period of existence, assigned cause, and form; whether previously irreducible, and if a truss had been worn.

When STRANGULATED, give the symptoms, *general and local*, dating from the exact period of strangulation, the first appearance of sickness, character of vomit.

PREVIOUS AND PRESENT TREATMENT.—If by *taxis*, state whether forcible, and how long applied, with or without chloroform; when by *operation*, if sac was opened or not,—if opened, *why ?* its contents and their appearances. On reduction, note the time from the first symptoms of strangulation; success, immediate and final.

WOUNDS.—Variety, position, extent, and depth; how, and with what produced; *when on scalp*, if exposing bone. Complications,—hæmorrhage, &c. Treatment and result, —whether united by adhesion or granulation.

TETANUS.—Idiopathic or Traumatic, partial or general; time of appearance after injury; position and condition of wound. Death,—whether from spasm or exhaustion.

DISLOCATIONS.—Form and position; simple or compound; how and when produced; previous Treatment.

SYMPTOMS, general appearance and position of the limb; mobility, pain, amount of injury to soft parts. Treatment,—time after injury; by manipulation or extension; mode of application of extension; its direction, duration, and additional means, under chloroform. Result, immediate and final.

FRACTURES.—Simple or compound; how and when produced; position and direction of the line of fracture; its tendency; amount of injury to vessels and soft parts; in *Compound*, note position and extent of wound; if produced by the primary force or broken bone; what vessels, nerves, or joints are involved. Constitutional symptoms.

TREATMENT.—Sand bags, starch bandage, splints; form of splint applied; date of application. Note the date of any change of local or general Treatment.

FRACTURED SKULL.—Position; kind of injury and direction of the force; if attended by hæmorrhage, its amount, and whether from nose, mouth, ear, or external wound. Give evidence, if any, of brain mischief.

IN SUSPECTED FRACTURED BASE.—Paralysis of facial nerve; flow of blood or serum from ear, with the time of its first appearance after the injury and its duration; condition of hearing; state of vision, and of pupils; presence of subconjunctival hæmorrhage. If complicated with internal injury, as *concussion*, *compression*, *&c.*; carefully report symptoms in their order of succession, and whether immediately following the injury or not; the duration, and amount of unconsciousness, insensibility; paralysis, its position, motion, sensation, or both; condition of sphincters; character and number of pulse, respiration; condition of skin. Treatment, &c.

DISEASED BONE.—Part affected; duration; cause, as external injury, syphilis, mercury; extent, superficial or deep, partial or general; previous Treatment, especially as regards operations.

Present Symptoms and Appearances.—Condition of dead bone or *Sequestrum*, fixed or loose; number and position of openings, or *external cloacæ*, with the date of their first appearance.

Treatment.—If by operation, its immediate success.

DISEASES OF JOINTS.—Part affected; date of first discovery; assigned cause, as injury. Note the early symptoms, in the order of their appearance; and date of any fresh symptom or marked change; if pain or uneasiness preceded swelling, or was coeval with it; if former, how long? Rapidity of progress; previous Treatment, and its effects.

Present Appearances.—Position of joint; if flexed, the angle of flexure; size and shape.

Character of Swelling.—Uniform or bulging; manipular indications, hard, soft, elastic, or fluctuating; mobility, amount; if attended with grating, &c.; in the knee-joint, note if the patella be free or not; if free, the sensation felt on moving it; condition of Skin; if fistulous openings exist; their position, number, and character of their discharge; deep or superficial; note the date of their first appearance, and if natural or artificial. Pain, acute or gnawing; its position, general or local; if aggravated by motion, or interarticular pressure; if increased at night. Sleep, if disturbed by crying or starting of the limb; sympathetic pain, and its position; condition of muscles of limb; constitutional symptoms. Treatment.

STRICTURE.—Organic or traumatic; duration and assigned cause, especially as regards gonorrhœa; use of injections, or accident; if previously treated by Catheter; complications, as abscess, fistula, with their position and date of appearance.

RETENTION.—Mention period of retention; preceding symptoms, and cause, as stricture, calculus, paralysis, abscess, prostatic disease, &c. Constitutional and local symptoms; previous and present Treatment; puncture per rectum, note the date of removal of the canula and arrest of the flow of urine through the wound.

EXTRAVASATION.—Cause, over-distension or accident; duration of retention before urethra gave way, and period that elapsed before being seen. Describe the appearances and extent of parts infiltrated; constitutional symptoms and Treatment.

VENEREAL DISEASE.—Chancre, duration; Position; glandular, urethral, coronal, or frænal,—external, internal, or fringing preputial; character, indurated, non-indurated, aphthous, raised, excavated, irritable, phagedænic, or sloughing; tubercle; condition of inguinal glands, indurated or inflamed. *Previous Treatment*, particularly as regards mercury.

Complications.—Note the date of appearance, and situation of each or any of the complications; the order and time of their occurrence after the primary sore. Present appearance and Treatment of each.

Gonorrhœa.—Date of contraction; former treatment, especially as regards injections, copaiba, &c. Complications, and their duration; in epididymitis, if following suppressed discharge; use of injections, copaiba, or violent exercise.

STONE IN BLADDER.—When discovered; date of earliest symptoms; if preceded by the passage of sand; amount of irritability of bladder; character of urine; constitutional and local symptoms. Treatment,—Lithotrity or Lithotomy; in latter, note any peculiarity; date of arrest of the flow of urine through the wound.

TUMOURS.—Date of its discovery and size; rapidity of growth; general and local symptoms, in their order of appearance. General health, prior to discovery, and since; hereditary tendency; assigned cause; depressing influences. In Mammary Tumours, number of children; date of birth of last; if ever suckled with affected breast, when; condition of the catamenia, if ceased, how long? Previous Treatment, and success.

Present Condition and Appearances.—Position of tumour; size, shape; external aspect and condition of skin; Pain, and its character; condition of lymphatic glands; manipular indications; mobility, when in breast, whether moved by traction of the nipple; Feel, hard, elastic, &c. &c. Constitutional symptoms.

Treatment.—In recurrent growths, give the date of former operations; date when healed; and of its first reappearance, and position.

OPERATIONS.—Describe position, direction, and number of external incisions; the steps of the operation as performed; its duration; number of vessels tied or twisted, and amount of hæmorrhage. In Amputations, the part amputated, and position of amputation. In Flap operations, give the position of the flaps; whether anterior, posterior, or lateral; whether performed by perforation or external incision. In the combined flap and circular, note the position of the skin flaps; in all, note the result and character of stump.

CHAPTER I.

ON REPAIR AND INFLAMMATION.

The repair of wounds after injury is a subject of so much importance that I have thought it well to devote an early chapter to its consideration; for, as in practice, the surgeon's aim is to place wounded parts, whether hard or soft, in the most favorable position for repair, and to remove all obstacles that are likely to interfere with the natural evolution of the process; so, it is incumbent upon him to know how nature proceeds in carrying out her end, in order that he may in no way by acts of omission or commission interrupt her in the performance of that desirable object.

Identity of repair in all tissues.

Reparative process.

And before entering into details, it is well to know, as a primary truth, that the processes of repair are identical in all tissues; that the reparative process in bone or muscle, integument or tendon, soft or hard parts, is the same, such modifications alone showing themselves as necessarily appertain to the anatomy of the tissue or special circumstance of its position. Thus, tissues that are highly vascular may undergo more rapid and more perfect repair than others less fortunately circumstanced, and bone tissues may require more time to unite than skin, but in all the process is alike. Let us therefore inquire what the process is, let us see what changes take place in parts undergoing repair; and let us look at them where they are best seen, when an incision is made through the skin and the edges are brought together.

Example, skin.

a. Immediate union.

The chief points that can be observed have reference to the capillaries, and in these, at the margin of the wound, the blood will be found coagulated up to the nearest anastomosis, and the capillary vessels in the neighbourhood will be seen dilated; this dilatation being caused by the increase of pressure to which the capillaries have been subjected by the altered circulation of the blood in the immediate vicinity of the wound. When wounds unite by *immediate union* no other changes than these take place, beyond the gradual restoration of the capillary circulation through the parts that have been divided, and under these somewhat rare circumstances no scar or cicatrix is left. The soft parts at first simply adhere together, and subsequently become continuous.

b. Adhesive union.

Should the wound unite by what is called *adhesive union* or *primary adhesion* (the "first intention" of John Hunter), in which a cicatrix is formed, other changes are to be seen; and these take place in the connective tissue—in which the vessels of the part ramify—a tissue that pervades every other, and which is made up of cell element and intercellular tissue, the cell element varying according to the nature of the part in which it is found.

Cell development.

These changes consist of cell multiplication, and under the circumstances supposed, we find between the edges of the wound a vast accumulation of cells, filling up in various degrees the spaces of this wounded tissue, and through these cells cicatrization takes place.

Whether this cell multiplication depends upon changes in the cell itself, as Virchow affirms, or whether the cells are direct exudations of the white corpuscles from the capillaries, as Cohnheim would lead us to believe, I do not purpose stopping to inquire, but rather accept the fact of their existence, which all admit. (*Vide* fig. 1, page 13.)

Formation of connective tissue.

Let us now consider briefly how cicatrization proceeds, and note that it is in the cells the most important changes are to be recognised. Those nearest the tissue gradually assume a spindle shape, and the intercellular tissue into which these spindle-shaped cells are infiltrated becomes denser. The spindle-shaped cells then gradually change into ordinary connective-tissue-corpuscles, and in this way new cicatricial tissue is formed. This new tissue, however, again undergoes changes—changes of consolidation. The intercellular tissue becomes gradually more condensed. The spindle-shaped cells gradually assume the flat shape of connective-tissue-corpuscles, and in a measure disappear, the nucleus often alone remaining. The fluid that existed in the newly formed tissue becomes absorbed, and the new cicatrix by degrees becomes firmer and denser, gradually contracting, so that at last the delicate scar of a large wound becomes solid and compact; the cicatrix in smaller wounds appearing only as a thin red, and at a later period as a white line.

Changes in capillaries.

Changes in the capillaries of the part, are, however, going on during all this period, and how far *all* the changes that have been briefly described are due directly to the capillary action is not yet determined. If Cohnheim's views become established, it is to the capillaries that the chief action in the tissues must be ascribed; if those of pathologists, such as Virchow and Billroth, are adopted, the capillary action will take a secondary place, acting through the cell elements. But on either theory the importance of the capillaries cannot be overlooked.

With regard to the changes in the capillaries, it has been already pointed out how at the beginning of the reparative process those of the part become sealed, and the collateral circulation in the neighbourhood becomes irregular and pressed upon; the coagula in these obliterated capillaries becoming reabsorbed or possibly reorganised as repair progresses, for it is certain that the capillary network soon becomes continuous through the newly formed cicatricial tissue, the capillary meshes of the one side joining by loops projected through the new tissue with the same meshes of the opposite one.

Influence of nerves on reparation.

What influence the nerves of the part have upon the reparative process we know not. That they have an important influence there can be little doubt, for all physiologists recognise their power upon secretion and nutrition, and the vaso-motor nerves doubtless have the greater power. But we must learn something more of nerve power generally and nerve distribution—something of the way in which the nerves terminate in the tissues, and what relation they bear to the capillaries—before we can hope to find out or understand the influence nerve supply has on repair.

c. Repair by granulation.

Development of granulations.

All wounds do not, however, heal by immediate union, primary adhesion, or first intention, and wounds that gape cannot so unite. The process of repair in these, therefore, differs somewhat in its character from those we have been considering; it *takes place by granulation*, or the "second intention" of Hunter. If we closely examine the surface of a wound thus exposed, we shall find that it becomes within a few hours of its exposure covered with a film of a peculiar gelatinous, greyish-white appearance, and if we examine this with the microscope, it will be seen to be composed of granulation-cells or white blood-cells. If the edges of the wound at this time be brought together, union may take place, the name of *secondary adhesion* being applied to this form of healing. As hours pass the parts covered with this gelatinous greyish film become more vascular, as indicated by redness, and the surface becomes more even. The film itself assumes a tougher character, and the wound secretes a yellow fluid, this fluid being mixed with small yellow sloughs of fibrinous tissue. The wound begins "to clean," and to have a smooth and consistent surface. After the lapse of another day, or some days, perhaps, this surface becomes covered with a number of elevations, varying in size from a millet-seed to a hemp-seed, the smaller being highly vascular and red, the larger being, as a rule, paler and more bloodless; these elevations are called *granulations*. The wound at this time is granulating. The secretion from these granulations is now of a creamy-yellow character, and is called *pus*. These elevations are made up of cells, called granulation-cells. They are like inflammatory lymph-cells, and are very vascular. Each granulation contains a vessel, the walls of which consist of a thin membrane, in which nuclei are embedded. "Some of these nuclei are arranged longitudinally, others tranversely to the axis of the vessels. In the development of these vessels changes occur, answering to those seen in ordinary embryonic development. Organisation makes some progress before ever blood comes to the very substance of the growing part; for the form of cells may be assumed before the granulations become vascular. But for their continuous active growth and development, fresh material from blood, and that brought close to them, is essential. For this the blood-vessels are formed, and their size and number appear always proportionate to the volume and rapidity of life of the granulations. No instance would show the relation of blood to an actively growing or developing part better than it is shown in one of the vascular loops of a granulation embedded among the crowd of living cells, and maintaining their continual mutations. Nor is it in any case plainer than in that of granulations that the supply of food in a part is proportionate to the activity of its changes, and not to its mere structural development. The vascular loops lie embedded among the simplest primary cells, or when granulations degenerate among structures of yet lower organisation; and as the structures are developed, and connective tissue formed, so the blood-vessels become less numerous till the whole of the new material assumes the paleness and low vascularity of a common scar." (Paget.)

Secretes pus.

Section of granulation.

Their vascularisation.

If, at this time, when the granulations have attained to the level of the skin, we look to the margins of the wound, we shall see a dry red band of newly formed tissue, with an outer border of a bluish-white colour, where it comes into contact with sound integument. This band is the new skin forming, and it is caused by the gradual growth of the epidermis from the margin of the sound skin towards the centre of the sore. This process is called *cicatrization*. The cicatrix is red at first, as in the linear cicatrix to which we have already alluded, but, as it contracts, it subsequently becomes paler, and more compact and adherent. The nature of the scar or cicatrix varies with the tissue in which it is formed, the new connecting medium or cicatrix under all circumstances having a powerful tendency to adapt itself to the peculiar character of the tissue in which it is placed. Thus, a cicatrix in skin becomes in time like true skin, a cicatrix in bone like true bone,

Formation of new skin.

and when connected with a divided tendon it becomes tough and hard like tendon; the consolidating reparative material in every instance partaking of the character of the parts with which it is connected. It is corpuscular in its origin, and clearly fibrinous in its nature; but whatever its origin may be, and about this men widely differ, its existence is undoubted, and through it and by it all repair takes place.

d. Repair by scabbing.

When wounds *heal by scabbing,* granulations do not form. In this process the reparative material which is poured out undergoes at once changes similar to those already described as taking place in adhesive union, and the wound cicatrizes rapidly beneath the scab; for the serum of the blood when effused on the surface of a wound is of a highly plastic nature, and rapidly coagulates to form a film of a protective nature, under which repair may rapidly proceed. Advantage is taken of this fact in the treatment of superficial wounds; the value of felt, cotton wool, or any such like material, when applied to an open wound, entirely depending upon this plastic blood property. This repair by scabbing is doubtless the best form of healing, although it is, unfortunately, somewhat rarely seen.

The *healing of subcutaneous wounds* must be somewhat similar. Some details of this process will be given in the chapter that treats of tendons.

Causes of non-repair.

I propose now to consider some of *the causes that interfere with repair,* and of these hæmorrhage must be placed amongst the most frequent. Blood, if effused to any extent between the edges of a wound, greatly interferes with the reparative process; it not only forbids all healing by immediate union, but interferes with healing by primary adhesion. If effused in very small quantities between the divided surfaces, it may at times possibly change into cicatricial tissue, and form a bond of union between the divided parts, and in certain other instances it may organise, as on the brain; but if effused to any great extent it will, probably, eventually break up and act as a foreign body, causing irritation and inflammation.

If *foreign bodies* exist between the edges of a wound, union cannot go on.

If *the wounded parts are much contused,* union can only take place by granulation or second adhesion.

If *the edges of a wound are allowed to gape,* or have too much tension upon them, the same observations apply.

If *the injured parts are not kept quiet,* repair cannot go on, as is best exemplified in fractures.

If *too little action* is present from deficiency of power, as we see in the very old and the very young, in plastic operations and the non-union of fractures, &c., union will not take place; and a like result ensues when *too much action* exists.

And this leads me to consider what too much action in a wound means; how it is to be recognised clinically and pathologically; and what are its results.

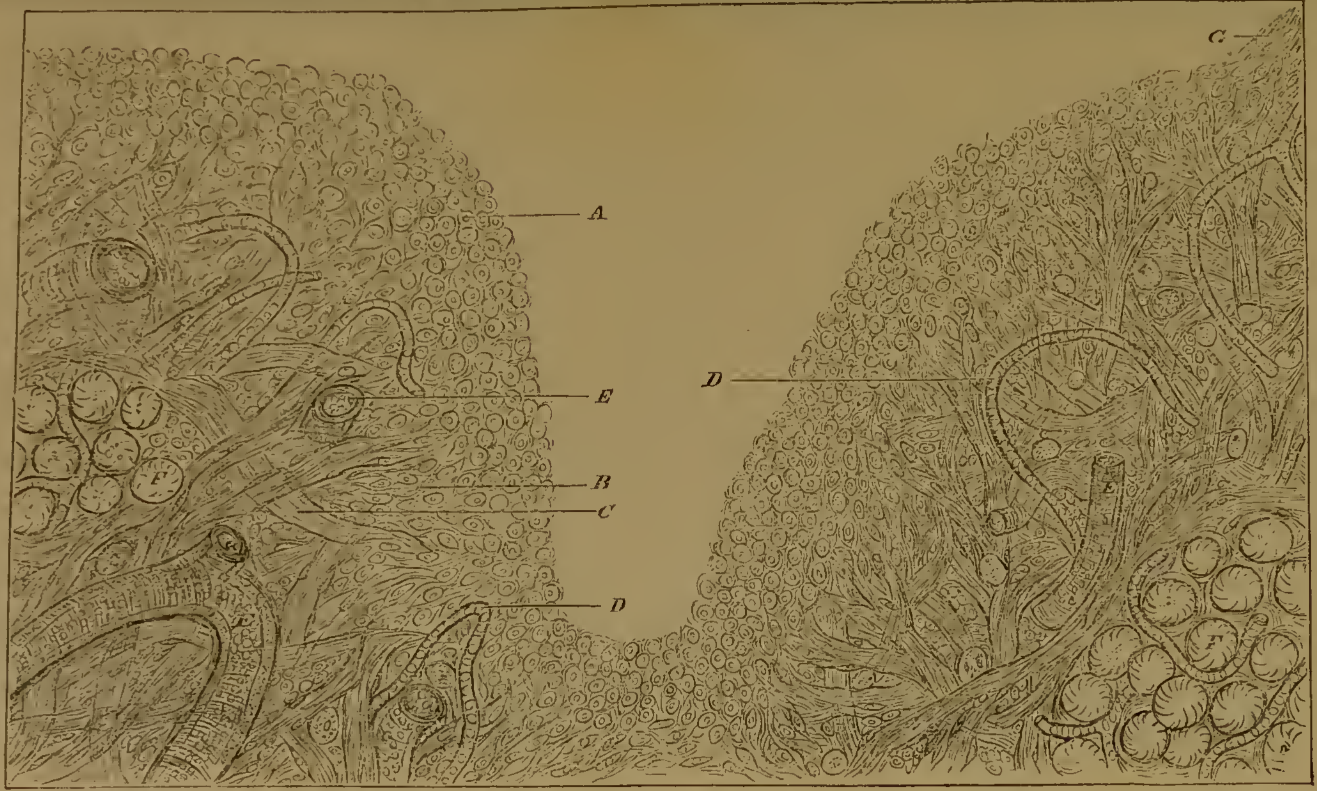
Inflammation.

It is commonly known by the term *inflammation;* and as this process, whether it affects a wound or any other part, has the same symptoms, I shall speak of it generally. As it affects a wound, so it affects the tissues; consequently the consideration of its phenomena in the one case will illustrate the other.

Fig. 1.

Diagram illustrating the process of repair in a wound filling up by granulation.

(This drawing has been made for me by my friend, Mr. Howse, from microscopical sections of granulation in his possession.)



A = Granulation-cells with single or double nuclei. These, when shed, are pus-cells. *B* = The same cells becoming spindle-shaped. *C* = Intercellular element becoming developed into bundles of white fibrous tissue. *D* = Capillaries. *E* = Small arteries. *F* = Fat-vesicles forming lobules. The two last structures constitute part of the original subcutaneous tissue. *G* = Superficial cells becoming converted into epidermal scales.

The Phenomena of Inflammation.

a. Redness.

When *a wound is inflamed* there are four points that strike the attention. The first is *redness*, which may appear as a mere blush on the edges of the wound, or may extend far and wide all around. It may be of a bright red colour or of a livid hue. The former tint indicating a healthy or *sthenic inflammation*, the latter an *asthenic*, evidencing want of power. The redness is doubtless due to the capillary injection of the part; and as we have already seen that in the repair of wounds capillary injection is a necessary attendant, so the redness of inflammation in a wound is simply the result of this carried to excess.

b. Increase of heat.

The second point is clearly connected with the first; indeed, it may be regarded as a result. It is *increase of heat in the part;* increase of action, as indicated by excess of vascularity, being generally accompanied by this symptom. There is reason to believe likewise that the blood is also over-heated.

c. Swelling.

The third point is likewise a striking one, and is clearly a result of the capillary injection, to which notice has just been drawn. It is *swelling of the inflamed part;* this swelling showing itself either as a simple œdema of the edges of the wound, or as a more or less general, diffused infiltration of the parts. This swelling is apparently produced by the passive exudation of the serum of the blood into the cellular tissue of the inflamed part, from the stagnation of the blood in the overloaded capillaries in the neighbourhood of the injured tissue.

d. Pain.

The fourth point is *pain*, this symptom varying much as to its intensity, and apparently depending a great deal upon the amount of swelling in the inflamed part, and its tension. In inflammation of the bone, periosteum, or any unresisting fibrous tissue, as the testis or the sclerotic of the eye, the pain is intense; in rheumatism it is also well illustrated. It is probably caused by direct pressure on the extremities of the nerves of the part of the swollen tissue. It may show itself simply as an increase of sensibility of the part or as a severe agony.

We thus have *redness, heat, swelling,* and *pain*, as symptoms of over-action of a part, or of what is called *inflammation*, and they, one and all, appear to be direct consequences of extreme capillary vascularity of the tissue, whether the result of a wound or not. They may manifest themselves in every degree of severity; their extent depending upon the intensity of the inflammatory action and the tissues that are involved. When a loose tissue is involved the redness will be much marked, and the swelling will probably be rapid; but pain will certainly be slight, as the tension of the part is rarely severe. When the connective tissue situated beneath a dense fascia or skin is involved, the redness and swelling are, as a rule, but little, for the peculiarities of the part affected prevent their being manifested, but pain will probably be severe, for the tension of the tissues, and the pressure upon the nerves of the part will, under such circumstances, be necessarily great.

When the inflammation is *acute* or rapid, all these symptoms manifest themselves with great rapidity, and the results of the action are quickly shown. When slow or *chronic*, their manifestation is less rapid, although equally well marked.

Inflammatory fever.

With these local symptoms of inflammation there will always be associated some *disturbance of the function of the inflamed part,* or probably its arrest; and what is of equal importance, some constitutional disturbance, which goes by the name of *inflammatory fever*. This fever may manifest itself in all degrees of severity, its intensity depending much upon the character of the inflammation and its seat. When the local affection is *acute*, or of a *sthenic* nature, the constitutional disturbance will be severe; when *chronic* it will probably be but little; and when *asthenic* it will be marked by great depression. This fever may show itself, therefore, only as a slight febrile state, or it may be marked by the severest symptoms.

The following description may be accepted as a type of the affection. I have taken it from Simon's masterly article in Holmes's 'System of Surgery,' 2nd edition, vol. i, p. 21:

Symptoms, example, compound fracture.

"Taking, for instance, a case of severe compound fracture, without much hæmorrhage, in a person otherwise sound and strong, we find that, before twenty-four hours have elapsed from the time of injury, his general system begins to be thus affected. He feels hot, or alternately very hot and chilly. His skin and lips and mouth are dry. He passes urine in less quantity, but of a higher colour, than usual. His pulse is quickened. A sense of general disorder gains upon him. He becomes restless and intolerant of disturbance. Signs of drought increase with him. His urine becomes scantier and more coloured. His skin feels hotter to the surgeon's hand, and his pulse, whether full or hard, is quicker and stronger than before. He craves more and more for water. His face has a flushed, anxious look. He is thoroughly uncomfortable; for the most part feeling distressingly hot, but at irregular intervals feeling touches of chilliness—sometimes even of such cold that he shivers with it. His sleep is troubled and unrefreshing; or, as night comes on, he gets delirious. His tongue, besides being dry, is furred. If his bowels act (which commonly they are inapt to do without laxatives) the excretions are morbidly offensive. Gradually these symptoms give way; in proportion as the injured limb ceases to be tense, and passes into suppuration, the skin and mouth become moist again; the excretions lose their concentrated character; the hard pulse softens, and the heart's action becomes quiet; the nervous system is no longer restless; the look of trouble passes from the countenance, and the patient can again take solid food."

Causes.

There can be little doubt that these symptoms are clearly due to an increase in the temperature of the blood, and that their severity is measured by it. This is, indeed, as Simon has so aptly expressed, "the essential fact of inflammatory fever. It is to this fact that the familiar language of feverishness bears witness,—the thirst, the scanty urine, the heat, and the shivering, the troubled brain, the excited circulation. As the blood gets hotter and hotter, more and more do these symptoms become developed. As the blood subsequently gets cooler so, more and more, do they decline."

Excess of temperature.

It seems from Dr. Montgomery's observations, made for Mr. Simon, that "febrile excesses of bodily temperature range perhaps to ten degrees above the normal heat of the blood; the 'crisis' of a febrile state consists in a rapid and generally continuous reduction, the 'lysis' in a slow and generally discontinuous reduction, of this abnormal temperature." With respect to the causes of this greater heat of blood, the results of inquiry seem to show "that either continuously during the intensity of feverishness, or else more abruptly when feverishness begins to subside, there can commonly be traced in the excretions an excess, more or less considerable, of those nitrogenous, sulphurised and phosphorised products which emanate from textural and humoral waste; that this increased elimination is observed even when ingestion has been reduced to a minimum; and that febrile excretions do, therefore, as a rule, undoubtedly attest an increased devitalisation of bodily material."

Excess of fibrin.

It seems highly probable that the blood, under these circumstances, contains more than its normal complement of fibrin, and that it coagulates with what is generally described as a "buffy coat." There is good reason also to believe that this "buffy coat" is due to the fact that the blood-corpuscles subside in the liquor sanguinis during the coagulation, leaving the upper portion of the clot colourless. What the meaning of this increase of the fibrin in the blood in inflammation may be is a question that remains to be decided. Some pathologists believe that the blood is excellent in proportion as it is fibriniferous; that solidifying fibrin is almost incipient tissue; that the fibrinous crust, as drawn in inflammation, is the sign of its being specially adapted to the purpose of additional growth; whilst others believe, and Simon, from whose writings the following quotation is made, ranks amongst them, "that the blood yields more fibrin, not in proportion as it is ripe and perfect, but rather in proportion to quite opposite conditions; that an increased yield of fibrin portrays not perfection, but post perfection in the blood; that it corresponds not to the rise, but to the decline of albuminous material; that the relations are not with repair, but with waste; that its significance is that of something intermediate between life and excretion; that the fibriniferousness of the blood is undiminished, probably even increased by bleeding; that it is greatly developed during starvation, during violent fatigue, during diseases essentially anæmic; that its increase, under these circumstances of exhaustion, weakness and inanition, is to the full as great as its increase during inflammation."

"These latter views seem to be most in accord with truth and with the general chemistry of inflammatory fever. They seem to indicate that the fibriniferousness of the blood in inflammation represents action of devitalisation and decay in some albuminous material. Whether this changing material be the inflamed texture gradually dissolving itself into the blood, or be the albumen of the fevered blood itself undergoing accelerated waste, cannot in the present state of knowledge be even approximately stated." (Simon.)

With this brief description of the phenomena of inflammation and inflammatory fever, I propose now to consider the *results of inflammation* on a part, or excess of action.

The Effects of Inflammation on a Part.

Effects of excess of inflammation.

When inflammation attacks a wound, or excess of action exists in it, repair is interfered with, retarded, or destroyed, in proportion to its intensity; anything like inflammation of the part is fatal to the immediate union of a wound, as it is to healing either by scabbing or secondary adhesion. In primary adhesion and in healing by granulation, an inflammation sufficient to pour out the primary cell tissue—plastic reparative matter, granulation tissue of Virchow, embryonic tissue of

Rindfleisch—does not appear to be injurious; but it must not go beyond this point. Here the natural reparative action of a part and inflammatory action seem to accord; the former being without doubt a healthy process, whilst the latter seems to be the former running to excess.

Arrest of repair.

When acute inflammation attacks a wound, either of the soft parts or of bone, there is an end to all repair, and partial union may be changed into complete disunion, or the inflamed tissue may die, wholly or in part. When soft tissues die they are said to *mortify;* when this action is a spreading one it is called *gangrene,* or *sloughing phagedæna;* and the dead part that is thrown off is known as a *slough.* The death of bone is called "*necrosis,*" and the dead piece of bone a "*sequestrum.*" When a portion of tissue dies, the dead piece is separated from the living by a process known as that of *ulceration;* when the ulceration spreads, an *ulcer* is said to exist; when this undergoes repair, it does so by *granulation.* Ulceration of a part means its molecular death.

Asthenic inflammation.

There is, however, a low or asthenic form of inflammation found in subjects of feeble and depressed powers which differs in a measure from that we have been considering. It usually comes on at some late period of the healing process, and manifests itself by clinical phenomena of a subdued character. Redness will be present, although it will not be of a vivid, but of a dull and dusky nature; swelling will exist, but it will be of an œdematous kind; the pain will be dull, and the discharge serous or sero-purulent. It affects repair as injuriously as the more sthenic form.

Such, then, are the chief local effects of inflammation on a wound; but there are others of no little importance to which attention must be drawn, and the principal one refers to the inflammatory exudation into a part.

Swelling and its varieties.

We have already stated that when inflammation attacks a tissue, swelling is one of the chief clinical signs, and this swelling is, without doubt, directly caused by effusion. The character of this effusion varies with the activity, character, or specific nature of the inflammation. When the inflammation is of a healthy or *sthenic* kind, it will tend towards the fibrinous variety, producing plastic infiltration of the part; when of a feeble or *asthenic* form, the serous and corpuscular elements will doubtless predominate. In the former case the soft tissues will appear firm and dense; in the latter soft and œdematous.

Resolution.

In healthy subjects this plastic infiltration may be re-absorbed, and the tissue into which it had been infiltrated be left perfectly sound; recovery taking place by what is termed *resolution;* in exceptional instances it may become organised. In unhealthy subjects the infiltrating material may break up or degenerate, and give rise to what we know as *pus.* When this forms in a part, *suppuration* is said to have taken place. Inflammatory lymph may consequently be converted into pus. Paget has pointed out, how, in amputating through a limb infiltrated with lymph, pus may flow from the wound in the course of a day, while it is known that in amputation through healthy tissue free suppuration does not usually appear till after three or four days. Under these circumstances the pus must have been formed by the conversion of the inflammatory lymph previously infiltrated into the divided tissues.

Suppuration.

"When an inflamed part is cut, the first pus is from lymph; the latter pus—when repair is in progress—is from granulation substance. In both cases alike the pus manifests itself as a rudimental substance, ill-developed or degenerated; and the transition from one condition to the other is an evidence of the impossibility of exactly defining between the inflammatory and reparative processes, unless we can see their design and end" (Paget).

"From these and like facts," says Paget, "we have an almost exact parallel, in their relation to pus, between the material for repair by granulation and that produced in the inflammatory process, and between, if they may be so called, the reparative and the inflammatory suppuration."

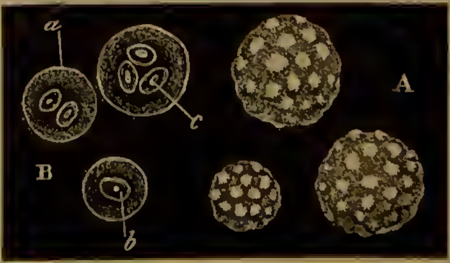
Sanderson's views.

Dr. Burdon-Sanderson's investigations, as given in 'Holmes's System,' have led him to regard inflammation as due to excessive irritation of the tissues, this irritation setting up, 1st, disorder of the circulation; 2nd, transudation of blood constituents; and, 3rd, alteration in the nutrition of the inflamed parts. Stasis of blood in the inflamed parts is the first effect of inflammation. This stasis, which is attended by the crowding together of the white corpuscles or leucocytes, is followed by their motion, and at last their passage through the capillary walls, and their accumulation in the tissues; the serum that exudes with them giving rise to swelling—these leucocytes forming the first purulent elements in the tissues. Cohnheim, indeed, considers these leucocytes as the sole source of purulent infiltration; but the facts before given fairly show that this cannot be the case, pus being probably a compound fluid of leucocytes and degenerated inflammatory tissue.

Pus.

Pus itself is made up of a thin transparent fluid and pus-corpuscles. These corpuscles are globular, and larger than the white corpuscles of the blood. They are minutely dotted, and contain three or four small dark nuclei; these nuclei become clear by the addition of acetic acid, and contain nucleoli (*vide* fig. 2). Acetic acid dissolves the nucleus of a white blood-corpuscle.

FIG. 2.



A. Pus-corpuscles (magnified 350 diameters). B. Same made transparent with acetic acid. *a*. Cell-wall. *b*. Nucleus. *c*. Nucleolus. (After LEBERT.)

Pus is also soluble in alkalies, and has an alkaline reaction. It contains from fourteen to sixteen per cent. of solids—chloride of sodium and phosphates. Dr. Day, of Geelong, has given us a new test for pus that is worthy of record. He prepares his test-fluid by exposing a saturated alcoholic solution of guaiacum to the air until it has absorbed a sufficient quantity of oxygen to give it the property of turning green when placed in contact with iodide of potassium. On moistening the most minute quantity of pus with water, and pouring a drop or two of the test-fluid over it, a clear blue colour is produced.

By means of this test he has made out that healthy pus, when dried, becomes chemically inactive, and non-susceptible to the test, although when moistened with water it resumes its chemical activity; whilst pus taken from an erysipelatous, carbuncular, or pyæmic patient, retains for many months, although dry, its chemical activity, and responds to the test at once. He believes, consequently, that a moist atmosphere promotes the spread of erysipelas and allied affections, and that a dry one retards it. He finds that carbolic acid destroys for ever the chemical activity of all pus-cells. (' Med. Times,' March 11, 1871.)

The investigations of M. Schultze have proved that pus when seen in a moist chamber and on a warm stage, exhibits very beautifully the amœboid movements; whilst those of Recklinghausen seem to indicate that the globular appearance of the pus-cell is a dead one.

ABSCESS.

On abscess.

Whatever may be the origin of pus, whether degenerated lymph, new cell growth the result of inflammation of areolar tissue, or escaped white blood-corpuscles, a *circumscribed* collection of pus in any tissue is called an "*abscess.*" When pus *infiltrates* a part, and is not circumscribed, *diffused suppuration* is said to exist; and this condition always indicates want of power.

Varieties.

An abscess that forms rapidly and is associated with severe inflammatory symptoms is known as an *acute abscess ;*" another, the result of a chronic action and of slow formation, as "*chronic or cold abscess,*" but there are many intermediate forms.

Pus may be absorbed.

Pus may, however, be absorbed, the serous fluid in which the cells float being taken up, and the cells left to wither, these cells subsequently forming a pultaceous, and, at a later date, a cretaceous mass. Clinically, however, pus may disappear altogether, and leave no external evidence of its former existence. The fact is now clearly recognised by surgeons; it is constantly seen, and is often watched in the disappearance of periosteal enlargements, chronic subcutaneous abscesses, and in the eye in hypopyon.

Varieties of pus.

Pus varies much in its character; it is often thin and watery, when it is called "puriform fluid," the pus-cells being ill formed, this condition being generally indicative of want of power. When it is blood-stained it is called "sanious;" when thin and acrid, "ichorous;" when it contains flakes of curdy lymph, "curdy." Bransby Cooper showed that pus from bone contains granular phosphate of lime, and Sir D. Gibb has collected sufficient evidence to prove that the presence of cyanurate of iron may give a bluish tint to pus. Pus from the brain is often green, from the liver brown, the *débris* of broken-down tissue in different proportions and kinds giving these characters.

Walls of an abscess.

The walls of an abscess are made up of organized fibrinous exudation, this exudation being a means adopted by nature to arrest the extension of the disease; around the wall the parts are always œdematous from serous effusion, as indicated by pitting on pressure. This fibrinous exudation forms what the surgeons of old called the pyogenic membrane.

On acute abscess.
Local signs.
Fluctuation.
Burrowing abscess.
Examples of burrowing abscess.

An acute abscess comes on with severe constitutional disturbance, fever, and sharp local pain, accompanied by the usual phenomena of inflammation, redness, heat, and swelling. As the abscess forms these local symptoms become intensified, and perhaps concentrated; the pain alters in character, it becomes at first dull and heavy, and then throbbing; the fever symptoms also subside, or rather intermit, a shivering fit or rigor, more or less well marked, followed by heat, and possibly sweating, taking its place. The swelling that was previously diffused becomes more localised; the parts covering it begin to thin, and with the fingers of one hand steadily kept flat upon the swelling, and those of the other made to press upon it in another part, the walls of the abscess will be made to bulge against the fixed fingers, and a sense of "fluctuation" be given, this feeling of fluctuation indicating the presence of fluid, and in this case of pus. If the case be left to nature, this thinning of the parts covering in the abscess will continue in the direction of least resistance, and when in the soft parts, towards the surface; the skin will either slough or ulcerate, and the abscess burst, discharging its contents. The pus having been evacuated, the walls of the abscess by their natural elasticity will fall together or collapse, the external wound close, and the whole heal or contract into a *sinus* or narrow canal, also called a *fistula*. When, however, the pus is *deep-seated*, bound down by fascia or periosteum, what is called "*burrowing*" takes place; the matter makes its way between the soft parts, where the least resistance is met with, and opens either into a mucous passage, serous cavity, or joint. Abscesses beneath the periosteum constantly open into joints; abscesses beneath the abdominal muscles, or within the abdomen, into the intestinal canal; abscesses beneath the deep fasciæ of the neck open into the pleura; and in the extremities, they burrow beneath the muscles, and make their way to the surface a long way from the original seat of the disease. Thus, in disease of the dorsal vertebræ an abscess may burrow beneath the abdominal fascia, behind the sheath of the psoas muscle, Poupart's ligament, deep fascia of the thigh, and open on the inside or outside of the thigh; in other cases it may pass into the pelvis, and out again at the sciatic notch, and appear in the buttock as a "gluteal abscess."

In disease of the lumbar vertebræ an abscess may form, burrow between the abdominal muscles, and appear in front of the abdomen above Poupart's ligament. An abscess beneath the scalp may undermine the whole scalp tissue; one behind the fascia and muscles of the pharynx spread so as to cause a large post-pharyngeal tumour, and suffocate mechanically; deep-seated abscesses of the neck may burrow into the thorax, and produce fatal mischief; but these instances are ample to show how pus, when confined beneath a strong membrane, will burrow along the cellular tissue of a part to find some external outlet, and how necessary it is for the Surgeon to be aware of the fact, in order that he may stop the process, or, as far as it lies in his power, prevent any harm following the act, or trace the cause of the disease back to its source, and find out its origin.

Acute abscess in bone.

Acute abscess in bone is attended with severe local symptoms and constitutional distress.

On chronic abscess.

Some *chronic abscesses* are of remarkably slow formation; they give rise to very little constitutional disturbance or local distress; indeed, except mechanically, they seem to be of little annoyance—unless they are secondary to some organic disease, and even then it is astonishing to what a size a chronic abscess will sometimes attain before it is discovered or complained of. In spinal cases this is often verified. In children, also, large abscesses form in the same quiet way; they are, however, never met with in the robust and strong. Abscesses connected with enlarged glands are peculiarly passive in their progress, and appear to cause pain only when they begin to make their way through the skin. The abscesses about joints, that appear during the convalescing period of the affection, when the joint disease seems to be undergoing recovery, show themselves in the same quiet way; they seem to be a simple breaking-down of old inflammatory products poured out in the cellular tissue during the more active period of the disease, and that had failed to be re-absorbed or become organized. They constantly undergo absorption, and should not be rashly interfered with.

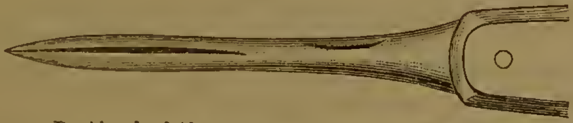
Treatment of abscess.

TREATMENT.—Wherever burrowing suppuration in a part can be made out to exist, the sooner an external outlet is made the better, whether that burrowing be beneath the scalp, behind the pharynx, amongst the deep cervical tissues, in the thecæ of tendons, between the layers of muscles of an extremity, or beneath the periosteum of bones, —particularly about joints or anywhere beneath the deep fascia, especially of the perinæum and anus.

By incision.

Superficial abscesses should always be opened, a lancet, or a fine double-edged knife with a central groove, being employed (fig. 3).

FIG. 3.



Double-edged Abscess Knife, with groove in centre.

On the neck and face the line of incision should be made to correspond with the course of the superficial skin muscles, or the lines or folds of the part; in this way the deformity resulting from the cicatrix is greatly diminished; but in other cases the incision must be in the best direction for emptying the cavity. In all abscesses the puncture should be made where the abscess is "pointing," or the integument is thinnest; and, where this indication is absent, at the most dependent part of the abscess. The operator should always avoid dividing superficial veins and nerves, the position of the former being made out by intercepting the flow of blood through them by the pressure of the finger. Deep vessels and nerves should be carefully avoided, their anatomical position being always recalled to mind; when abscesses have to be opened in their neighbourhood, the incision should be made parallel to them.

Avoid deep vessels.

Mode of opening abscesses.

In opening an abscess no plunge is to be made; the operator is to mark the point of puncture with his eye, and having taken his instrument introduce it with decision through the soft parts into the cavity, and, as soon as pus oozes upwards by the side of the instrument, the incision is to be made of the required length by cutting outwards.

To do this act sleepily is to give unnecessary pain; to do it with a stab or plunge, to cause unnecessary alarm; it is to be done as every other act of surgery, with confidence and decision; boldness and rapidity of action being governed by caution, and made subservient to safety.

To open an abscess that is pointing, or that has a cavity which is to be felt, and is not covered by parts that it would be dangerous to wound, by cutting down upon it as if dissecting, is a *bad* practice; although in deep-seated abscesses, where surgical interference is called for, and in which it is dangerous to introduce a knife through any thickness of tissue, such a method may be the best—extreme caution being justified under extreme danger. It is under these circumstances that what is known outside Guy's Hospital as Mr. Hilton's method of opening deep-seated abscesses is so good. The practice has been followed at Guy's for many years, and was first publicly explained by Mr. Hilton in his excellent 'Lectures on Rest,' 1863.

Hilton's method.

In deep-seated abscesses in the axilla, says Hilton, "I cut with a lancet through the skin and cellular tissue of the axilla, about half or three quarters of an inch behind the axillary edge of the great pectoral muscle. At this point we can meet with no blood-vessels. Then I push a grooved probe, or grooved director, upwards into the swelling in the axilla; and, if you watch the groove, a little opaque serum or pus will show itself. Take a blunt (not a sharp) instrument, such as a pair of dressing forceps, and run the closed blades along the groove in the probe or director into the swelling. Now, opening the handles, you at the same time open the blades, situated within the abscess, and so tear open the abscess. Lastly, by keeping open the blades of the forceps during the withdrawal of the instrument, you leave a lacerated tract or canal communicating with the collection of pus, which will not readily unite, and will permit the easy exit of matter." In this way deep cervical and post-pharyngeal abscesses, deep abscesses of the thigh, leg and forearm, may be fearlessly opened.

After-treatment.

When an abscess has been opened it should be left to discharge by itself, a simple poultice or warm-water dressing being applied over the surface. No squeezing or pressing the walls of the abscess is wanted; such means are both unnecessary and injurious. In some abscesses it is well for a few hours to leave a piece of lint covered with oil between the edges of the wound, to prevent its closure, more particularly when the deep fascia has been opened. In others, the introduction of a "drainage tube" made of a piece of india-rubber tubing perforated at intervals may be required.

Tonics and diet.

Tonics and good feeding are always essential elements in the treatment, sedatives being given only when required.

During the formation of an abscess fomentations, poultices, and warm-water dressings give comfort, and may be used; they are only admissible, however, when suppuration and external discharge is looked for. When absorption is probable such means should not be employed; this result can, however, only be expected in chronic abscesses, and where such exist, and are not connected with deep-seated mischief, their disappearance by absorption may be reasonably hoped for. The local affection then requires no other treatment than rest and an absence of all irritating applications; tonic treatment and regimen being the chief means upon which reliance can be placed.

Use of aspirator.

On some occasions I have drawn off the pus from a chronic abscess with the aspirator, and no re-collection has taken place, but as often as not, however, the fluid re-accumulated, and a free incision was subsequently required. Whenever an abscess is opened the incision should be free enough to admit of a ready outlet of its contents, and to forbid any re-accumulation.

When early opening requisite.

In acute abscesses about the hand or foot an opening cannot be made too early; that is, when effusion has taken place, and the soft parts are tense. Under these circumstances an early incision will often save tissue, and the operator must not think that he has done wrong when on making the incision he finds no pus exude.

Lister's plan of opening chronic abscess.

When chronic abscesses require opening, a practice that is not always to be followed, the adoption of Mr. Lister's plan of covering the opening with piece of lint soaked in carbolic oil, to prevent the possible admission of air or any septic matter, seems certainly a good one. Whatever the theory of its goodness may be, the practice is worthy of adoption. I have treated a case of abscess filling the left loin and abdomen as far as the median line, and showing below Poupart's ligament, in a young lady, æt. 18, by these means, and evacuated quarts of pus, the whole closing within a month, or rather degenerating into a small sinus that discharged serum for three or four weeks and then closed without the slightest constitutional disturbance. The origin of the abscess was very obscure. I have treated likewise a spinal psoas abscess, a large one of the thigh, and another of the loin, with equal success; a fifth also, clearly renal in its origin, might be recorded to support the practice.

Free opening.

The practice consists of a free opening into the abscess, and, as the pus flows, the application of a piece of lint soaked in carbolic oil, one part of acid to twenty of olive oil, care being observed in the dressing that no air be admitted into the abscess unless charged with the vapour of the acid. The lint should only be removed to be replaced by a freshly steeped piece, and no pressure made upon the walls of the abscess to empty its cavity without the opening being covered with carbolic oil. I have used, in several cases, olive oil alone with an equally good result. With the same view of excluding air and its impurities, the use of the trocar and canula has been suggested, a valvular skin opening being secured by drawing the integument to one side before making the puncture. The trocar invented by Mr. Thompson, of Westerham, is also good: in it an elastic tube is fitted to a second mouth below the instrument. But beyond any of these in their usefulness, when such a practice is wanted, Dr. G. Dieulafoy's "aspirator" is to be recommended; for by it the contents of any cavity can readily be *explored* or withdrawn without a possibility of the entrance of air. As a rule, however, where an abscess wants opening, a *free* opening is desirable, care being taken that, where air enters, its exit can be guaranteed, the cavity being washed out freely as often as occasion calls for it. In this way suppurating ovarian and hydatid cysts may be treated as large abscesses, and with good success. Empyemata or abscesses in the chest can also be treated on the same principle, with a free opening into the thorax and a free outlet for the pus. In this case the drainage tube is of great value, care being taken to drop one end of it well down to the bottom of the cavity.

Trocar and canula.

Aspirator.

Drainage tube.

The drainage tube was suggested by M. Chassaignac; it is simply a small india-rubber tube, perforated every inch or so with small holes, to allow of the free escape of the pus. When used in large cavities, the cavity should be washed out, with or without Condy's fluid, at intervals, so that nothing like decomposition, as indicated by fœtor, should be allowed. With this precaution large suppurating cavities can be dealt with successfully.

When veins and large arteries open, by ulceration, into abscesses —an accident of occasional occurrence—they must be dealt with on the principle laid down in the chapter on hæmorrhage.

Abscesses associated with enlarged glands.

Chronic abscesses associated with glandular enlargement need not be opened under all circumstances, for with constitutional treatment they often disappear; but they should be so treated as soon as it is clear that they will open by natural processes, in order to save the ugly cicatrix that takes place under these circumstances from ulceration of the skin. The surgeon should open them by making a small puncture in the best line to allow of the exit of the pus and to prevent disfigurement. Gentle pressure with cotton-wool over the part afterwards often hastens the recovery. In subjects of the hæmorrhagic diathesis an abscess may be opened by the moxa or canula.

Arrest of Acute Inflammation by the Obstruction of the Main Artery of the part.

On arrest of inflammation by deligation of main artery.

Examples.

To arrest acute inflammation in a limb the deligation of the main artery of the limb, or the arrest of the circulation through it by pressure upon the artery, has been adopted. Dr. Campbell, of New Orleans, speaks highly of the practice, and even affirms that no portion of an extremity should be amputated for destructive inflammation without the Surgeon attempting the practice. On the suggestion of Mr. Maunder, of the London Hospital, in 1867, Mr. Little applied a ligature to the femoral artery for acute suppuration of the knee, with a success sufficient to prove the value of the practice, and Mr. Maunder has since successfully carried it out, ("Lettsom. Lect.," 'Lancet,' 1875); the late Mr. Moore, of the Middlesex Hospital, acupressed the brachial artery with a good result. Previous to these cases, however, as early as 1813 Dr. Onderdant, of America, ligatured the femoral in a case of wound of the knee-joint, to check acute inflammation, and other surgeons since his time have followed his practice. It is a method of treatment certainly worthy of attention, for, to cut off the supply of blood to an inflamed part, when too much exists, is a sound theory, and to do the same to starve a disease is equally scientific. In elephantiasis Arabum the practice does not seem to be without its good effects, and in acute disease it is admissible.

I well remember, as a student, watching a bad case of compound fracture of the leg, complicated with a severe laceration of the thigh of the same side, and division of the femoral artery, under the care of Mr. Bransby Cooper, in which he was in doubt as to the practice he ought to follow, not knowing whether with the divided femoral the supply of blood would be sufficient to repair the compound fracture; but the success of the case proved that the fear was a groundless one, for repair went on uninterruptedly well, and a good limb was the result; the patient was a man of middle age. And in 1873, I treated with uninterrupted success a case of compound fracture of the humerus into the elbow-joint in a man, in whom the brachial artery was obstructed, a movable joint being secured.

With respect to the treatment of inflammation by the *digital* compression of the main arterial trunks leading to the injured or diseased parts, it must be recorded that in 1861 Dr. T. Vanzetti, of Padua, wrote a paper upon it, which Mr. S. Gamgee has recently translated in his work 'On Fractures,' 1871. He was led to apply this treatment to cases of inflammatory disease from its success in the treatment of aneurisms. He writes that compression will cure every incipient inflammation, and check it even when advanced. He gives cases of phlegmonous erysipelas and acute arthritis of the hand successfully treated by these means. He adds, however, that "in the treatment of aneurisms as of inflammations compression can never become a normal method until it be always and exclusively effected with the finger." On digital compression of main artery in inflammations.

SINUS AND FISTULA.

A fistula is an unnatural communication between a normal cavity or canal and the outside of the body or second cavity or canal. On sinus and fistula. Definition.

A sinus is a narrow suppurating tract with only one orifice.

Both will here be considered together. Thus, amongst the *fistulæ*, there are the vesico-vaginal and recto-vaginal fistulæ in women; the recto-vesical in men; fæcal fistulæ, gastric and biliary fistulæ, anal fistula, salivary fistula, urinary fistula; they are always due to some suppurative or ulcerative process, or mechanical violence, operative or otherwise, and to a want of repair subsequently. When passages are close together, the fistula will be a short direct one; in some large, in others narrow or tortuous. When the cavity or canal is deeply placed, or the inner opening of the fistula deeply situated, the fistula may be a long narrow tract. When the fistula is of *recent* origin, the walls will be soft, as of granulations discharging *pus*, readily bleeding on manipulation. When *old*, they will be smooth and hard, "callous" all over, and non-sensitive, secreting a thin, watery, non-purulent fluid. This fluid will, moreover, be mixed with the contents of the cavity or tract with which the fistula communicates, this discharge tending to keep the fistula open. Varieties of fistula.

The *external* opening of a fistula or sinus presents very different appearances; it may appear as a direct opening, a valvular opening, a depressed or raised one; when leading down to a foreign body or bone, the external orifice will be surrounded by weak granulations. Sometimes it may scab over for a time, and then reopen by the force of the retained fluid. External orifice of fistula.

The *internal* opening of a fistula mostly appears as a defined orifice. Internal orifice.

Of *sinuses* or incomplete fistulæ, abscess is the most common cause; the external communication failing to heal from some defect in the healing power of the part; from some interference with the reparative process; from the constant discharge of pus, which has not a sufficiently free vent; or from muscular action, which forbids that amount of rest of the part required for its repair; or lastly, from the presence of some foreign body introduced from without, from dead bone or cretaceous inflammatory product from within. Of sinuses.

The TREATMENT of the different forms of fistulæ is given in the chapters devoted to the special organs that are involved. In a general way, however, it may be said that as long as the cause of the fistula exists repair cannot go on; that is, in urinary fistula, when Treatment of fistula.

Remove cause.

stricture is the cause, the stricture must be treated before the fistula. In anal fistula, when the action of the sphincter ani forbids repair, its action must be paralysed. In fæcal fistula, when obstruction to the bowel is present, the obstruction must be removed. In salivary fistula, the salivary duct must find a natural outlet before its unnatural orifice can be expected to close. When any foreign body, tooth or dead bone, is present, keeping the sinus open, it must be removed. When a suppurating cavity at one end of the fistula keeps on discharging, means must be taken to close it, and so on. When these objects have been achieved the attention of the Surgeon may be directed to the fistula or sinus itself, and various are the means that have been employed.

Pressure.

Pressure in *recent* sinuses, to keep the parts in apposition, by means of pads, strapping, or bandages, is sometimes of use, the muscles that move the part being kept absolutely at rest. In stumps, and after mammary abscesses, this practice is very good.

Injections.

Injection of some stimulating fluid, such as the preparations of iodine, either as the compound tincture or that diluted with one or two parts of water, will sometimes set up a more healthy action; for the same purpose a *seton* has been used, but of all setons the small *drainage tube* is the best, or a narrow coil of rolled gutta-percha skin. I like this better than Ellis's spiral wire drainage tubes, although they are good. The *cautery* is often of great use, and the galvanic is its best form; it can be so accurately applied to the exact spot, and its heat can be maintained; it is most useful, however, in small fistulæ.

Seton.

Cautery.

Laying open fistula.

Laying open the sinus is, however, as a rule, the best plan, dividing it from end to end, and keeping the sides asunder to allow of its healing upwards. This may often be done with striking advantage with the wire of the galvanic cautery. When done with a knife, the incision is to be made upon a grooved probe or director which has been previously introduced through the sinus. When the cautery is used, the wire should be passed through the sinus on the grooved director, or threaded in an eyed probe, the Surgeon then holding the two ends of the wire, made hot by contact with the battery, and dividing the tissues with a sawing motion. The division with the cautery has this advantage, that the surface of the sinus is so destroyed that it must granulate; there is consequently less need of careful dressing; and in old sinuses this is a point of importance, for their surfaces are so callous that they require to be scraped or otherwise rendered raw to permit of granulations forming.

Division by cautery.

The division of a fistula with the ligature is now rarely done, although with an india-rubber ligature it may be feasible. In "bleeders" it might be called for, but in these the wire of the galvanic cautery is preferable when it can be obtained.

Plastic operations for the cure of fistulæ are also means of great value, particularly of vaginal and rectal fistulæ. They will be discussed in another chapter.

Constitutional treatment of fistula.

Last, but not least, in the treatment of sinuses and fistulæ constitutional treatment is to be employed. In the fistula following operative or suppurative action such treatment is, as a rule, all that is wanted, and many are the cases in metropolitan hospitals of sinuses about stumps, skin wounds, or mammary wounds, that heal rapidly under the influence of fresh air, good food, and tonic medicine.

In all cases these means are most essential, and with them and local treatment success is generally to be secured.

ULCERS OR SORES.

Ulceration is an inflammatory process, in which a *sore* or *chasm* is produced by the molecular death of the tissue involved.

A sore is a chasm, a solution of continuity, caused by ulceration upon an external or internal surface of the body.

Definition of an ulcer.

When a *sore* is being formed, or is spreading by the process of ulceration, an *ulcer* is said to exist; when the ulceration has ceased, a *sore* remains.

When an *ulcer* spreads slowly it is called a spreading ulcer; when it spreads rapidly by ulceration it is termed *phagedænic;* when the ulcer spreads by gangrene the ulcer is said to be *sloughing;* and when with this gangrene, the molecular death of the tissue, or ulceration, is combined, *sloughing phagedænic* ulceration is said to exist. All these processes are consequently different forms of spreading ulcers, and are characterised by the degrees of rapidity of the process; the simple ulcer being the mildest, and the sloughing phagedænic the most severe form.

Varieties according to progress.

A healing ulcer or sore heals by *granulation* and *cicatrisation,* the process of healing being the same in it as it is in any open wound, the result of injury or operation. Sores may be *healthy, inflamed, weak, indolent, sloughing from excess of indolence,* or *irritable,* terms which are applied to sores to express their conditions at the time, but having no special signification, for these appearances fluctuate according to the general condition of the patient and the local treatment of the sore. A sore may also at any time take on the ulcerative process and spread, or assume any of the forms of spreading ulcers already given.

Varieties according to condition of ulcer.

An ulcer may originate from a *local* or *constitutional* cause.

Amongst the *local causes* are injuries produced by blows, pressure, or some irritating application, some skin eruption, or something that sets up or is followed by inflammation and subsequent ulceration. A piece of skin dies, it is cast off by ulceration; a portion of integument inflames from some external irritation, a local eczema or skin eruption, and an ulcer results. An abscess forms beneath the skin or in the deep parts, and bursts by ulceration; it may be that some deep-seated disease was the cause of the abscess; the ulceration spreads and remains as an ulcer.

Local causes of ulcer.

Amongst the *constitutional* causes, *excluding cancers,* may be classed anything that induces a low condition of the vital powers, such as any illness or certain habits of life, syphilis, or scurvy.

Constitutional causes of ulcer.

It should be remembered, however, that ulcers which have a constitutional origin may be kept up by local causes; thus a syphilitic or cachectic ulcer originating from a general cause may take on any of the characters common to the healing ulcer or sore; in the same way that a local ulcer or sore, produced from local causes, may fail to heal from some constitutional defect.

Lupus, rodent ulcer, epithelial or carcinomatous ulcers, stand by themselves; they are called *special* ulcers.

Special ulcers.

There are, then, local sores originating from local causes, that are often kept from healing through some general or constitutional failing; constitutional sores originating from constitutional causes, that may fail to heal on account of some local condition interfering with repair; and special sores; and for their treatment it is most essential that the three different forms be recognised.

A local ulcer.

Local sores, as already stated, have a local origin; something sets up inflammation and ulceration in the skin, and a sore remains; the disease is cutaneous from the first. The few cases connected with disease of the deep-seated parts, such as the bones and joints, can readily be made out.

A constitutional ulcer.

Constitutional sores have rarely a cutaneous origin, unless originating in some ulcerating skin eruption, such as ecthyma or rupia; but they almost always commence in the subcutaneous connective tissue as a more or less circumscribed induration, which lasts a very variable period, and then softens down, the skin over it inflaming, sloughing, and ulcerating, to give vent to a slough; the sores or ulcers always being of a *cellular membranous kind.* These ulcers may have their cause in an ordinary cachexia or in syphilis, but the cellular membranous ulcer is always constitutional, and requires general more that local treatment. In syphilis the ulcers are the result of broken-down subcutaneous "gummata." The appearance of these sores will depend much upon the period at which they are seen, but, following them up from the time when the skin has broken and ulcerated to give vent to the sloughing cellular tissue, the margins of the skin opening will appear thin, irregular, and undermined; at the bottom of the opening the slough will show, and when non-syphilitic it will appear more or less white, sometimes pearly, but when syphilitic it will have the aspect of a *piece of wet wash leather*, at least in the majority of cases. When the slough has come away the skin will at first be undermined, and the margin of the sore fall inwards, but as the granulations rise from below, the skin will be pressed up, although when the wound has cicatrised the scar will almost always be a depressed and in syphilis a stained one.

Around this sore several small openings often coexist, each one having formed to give exit to a small slough, the margins being cut as if punched. These sores mostly occur about the lower part of the thigh and knee, elbow, shoulder, and forehead; they are found, however, in any part of the body. The syphilitic are always surrounded by a *dusky* kind of inflammatory border, and are rarely painful; the non-syphilitic with a pinker blush. The wash-leather slough and dusky margin fairly indicate the syphilitic sore.

The special sores will be described with the diseases from which they result.

Characters of a healthy ulcer.

A healthy, healing, cutaneous sore is known by the small, florid, conical granulations that cover its surface, and the healthy creamy pus that they throw off. The granulations are not so vascular as to bleed, or so sensitive as to cause pain on the slightest touch. Its margin is natural, and where the skin and granulations meet a band of cicatrising tissue is to be seen, this band assuming, where in union with the skin, a whitish line with a fine covering of epidermis; where in contact with the granulations a more vascular appearance than at any other part of the sore, the centre of the band being covered with a thin, purplish-blue, semi-transparent film.

By the gradual cicatrising process of the outer border of the band inwards, and the gradual narrowing of its circle, the sore heals, the Surgeon's sole aim in its treatment being to guard it from anything than can interfere with the progress of repair.

Treatment of healthy ulcers.

The *treatment* is, therefore, simple, a piece of wet lint to absorb discharge and protect its surface from injury being all that is usually called for, and the lint being kept moist by a piece of oil silk, gutta percha, or elastic tissue. Where water irritates, oil may be substituted. The surface of the sore should be cleansed by means of a stream of tepid water; sponges should not be used. Cotton wool is the best substitute, and it can be destroyed after use.

Where the granulations are disposed to rise too high, dry lint may be applied, and at times a good rub with lunar caustic hastens recovery. Small sores thus treated may be allowed to scab. Rest is always beneficial to aid repair, but should this be impracticable a good bandage should be substituted, a piece of thin sheet lead bound over the sore and its dressing giving good support. In removing the dressing care should be observed not to injure the band of delicate cicatrising tissue.

Deviations from typical ulcer.

Accepting the description given as a type of a healing sore, deviations from this type constitute the different forms that have been described. Thus, when the granulations assume a large, pale, elevated, watery appearance, the sore is said to be a *weak* one, the granulations in popular language being "proud flesh," the popular word *proud* being synonymous with *weak*. There is power in the sore to granulate, but the granulations have little power of cicatrising; they are disposed, moreover, to slough on the slightest cause. These sores require local stimulants, such as the nitrate of silver in stick, and dry lint, sulphate of zinc or copper lotion, in the proportion of two grains to the ounce, or carbolic acid lotion of the same strength. Dusting the surface with powdered alum or tannin is sometimes of use, the limb being carefully elevated or bandaged, and the general health attended to.

The weak ulcer and its treatment.

The indolent and callous ulcer.

When there is still less power in the sore no granulations form, the surface puts on the appearance of a piece of mucous membrane, such as that of the pharynx, and the sore is then called *indolent*. At times a few weak granulations crop up at one corner of its surface, but the greater part has a smooth and glassy aspect, and the secretion from it is thin and watery, not purulent. Where the sore has existed long the edges will be raised and indolent, covered with a layer of epithelium, and very senseless, thus acquiring the term "*callous*," a callous sore being an indolent one of long standing. This indolent sore is always ready to take on a sloughing action on any slight cause, such as some general derangement of the health or the long assumption of the dependent position of the limb. It is common, indeed, to find the surface of the indolent sore *sloughing;* not, however, from inflammatory action, but from *excess of indolence in the granulating force.* Under these circumstances the surface of the sore becomes covered with a greenish secretion, often fetid, the granulations forming partially and then dying. When the sore is large this appearance is very common towards the centre, or the lowest part of the sore; and as repair goes on, the sore may cicatrise at its edges, where the granulations derive the full benefit of the vascular and nerve supply, the centre of the sore still sloughing. In old people the margin of the sore may slough in one part and heal in another. Authors

May become sloughing.

Senile ulcer. have described this indolent sore in the old as *senile ulcer.* These sores are very common; they are usually found in the lower extremities, and often associated with varicose veins; this condition of veins having little to do with their origin, although much with retarding their recovery. They have been described by old authors as *varicose ulcers,* simply from the fact of the two conditions being often found together.

These are almost always found in feeble subjects, with a feeble circulation.

Treatment of indolent ulcers.

The treatment of these indolent sores consists in encouraging the venous circulation of the part by position if possible, and by pressure where rest cannot be secured; by local stimulants, and general tonic treatment. When there is little or no action in the sore, the application of one or more blisters to the surface is very valuable; or blistering liquid may be painted over its edges. When the surface is sloughing, from excess of indolence, half an ounce of carbolic acid to a pint of olive oil, with or without the extract of opium, according to the amount of pain, is a capital application, or any other stimulating solution. Where the edges of the sore are indurated and callous, so that cicatrisation and contraction is almost impossible, the free scarification of the margin every half inch is often followed by a rapid change for the better; or two free incisions may be made on either side of the margin of the sore for the same purpose; and during this treatment, when the leg can be raised higher than the hip, the venous circulation being thus assisted, the utmost good may be obtained. When rest cannot be observed the limb may be strapped up from the toes to the knee—omitting the sore—firm pressure being applied by means of a bandage over the dressings covered with a piece of sheet-lead. In private practice, when the leg can be dressed daily, the whole limb may be covered with the strapping. The strapping, however, must be good, not such thin stuff as that spread on calico, nor thick felt strapping, but that spread on linen, such as is sold by Leslie or Messrs. Gerrard and Co., and used at Guy's Hospital.

May become painful and irritable.

When the sore is painful, or the patient has an irritable pulse, the beneficial effects of opium twice a day in a pill are very marked; and quinine, iron, nux vomica, or the vegetable bitters, may be given, as the wants of the case indicate. The bowels also require attention; drachm doses of the sulphate of magnesia, with quinine, being a good aperient.

Transplantation in extensive ulcers.

When the sore is a very large one, and the probability of the whole healing is small from loss of skin, fresh centres of *cutification* should be inserted by transplantation, for in this way I have brought about the cicatrisation of a large sore of twenty-four years' standing in three weeks, and many others of small size in an equally short period; indeed by this practice of skin grafting I believe the necessity of amputation in the more severe forms of this affection will be greatly diminished; for hitherto indolent ulcers that surround a limb have always proved themselves incurable, and amputation has been their only remedy.

The inflamed ulcer.

All sores may inflame or become irritable, but there is an *inflamed sore* or *ulcer* which is found in subjects with thin and fair skins who are in some way reduced in power, or "out of sorts," either from irregular living, over-work, or bad feeding, that appears as a small

Eczematous.

superficial, inflamed, irritable sore, with a raw-looking appearance, an ash-coloured slough, or thick secretion over its surface, and discharges a thin, ichorous fluid, sometimes tinged with blood. The patient will complain of its excessive painfulness, particularly at night, and will dread its being touched; it will look red and angry, yet superficial. A blow or a graze may have started the sore, or a local patch of eczematous inflammation, when it may be described as an *eczematous ulcer.*

Treatment of inflamed and irritable ulcer.

The *treatment* of these sores is very troublesome, the skin being usually highly sensitive; they always want soothing, and the best lotion is one of lead mixed with the extract of opium, but this sometimes irritates, and the lead or zinc ointment gives comfort, at other times a cold bread poultice is the best application. In all cases the limb wants rest and elevation; plasters will rarely be tolerated. In the eczematous sore, where the discharge from the eruption round the sore is profuse, the powdered oxide of zinc and starch, in equal proportions, may be used; or the surface may be washed with a solution of nitrate of silver, in the proportion of ten grains to the ounce; and at times a solution of the extract of opium is the best lotion; simple nutritious food, with a moderate allowance of stimulants, must be given, but all high feeding is bad; the general health mostly requires tonics of a non-stimulating kind, such as the vegetable bitters with alkalies, the intestines being generally irritable. When pain is severe, opiates and sedatives are indicated. In very inflamed sores the application of a few leeches, at some distance from the sore, at times gives relief. These sores are always obstinate.

Varicose ulcer.

Ulcer associated with varicose veins.

Authors describe a *varicose ulcer,* but it is a great question whether such a special ulcer exists. Many indolent sores are doubtless associated with varicose veins, and are probably indolent on account of this association; but how far they are really caused by them is a different thing, for varicose veins and ulcers of all kinds are constantly met with together, and it would be as just to describe all ulcers as varicose as any single one. Of all ulcers entitled to the term varicose, the eczematous one has probably the most claim, for certainly eczema of the leg is a common consequence of varicose veins, and an eczematous ulcer a result.

Must treat the varicose veins at the same time.

Practically, however, it is right to remember, that when varicose veins exist with an ulcer, repair cannot go on favorably unless the venous circulation of the limb be assisted by position or pressure; and that where these varicose veins are present, all ulcers or sores are disposed to become indolent if neglected. When an ulcer takes its origin from an inflamed vein the term is, in a measure, applicable, but this ulcer has no special characters.

Sores that are prevented from healing by varicose veins must be treated by the elevated position of the limb, bandaging or strapping, and in bad cases by the obliteration of the veins. Without such the treatment of the sore will, of necessity, fail; with it the sore may be expected to heal with the use of such general and local means as its nature may require.

Question of healing chronic ulcers.

How far it is right to heal an old chronic sore is not quite decided. The older surgeons used to say it was inexpedient to do so, as cases were met with in which apoplexy or some other alarming condition followed. But modern surgeons are disposed to question the explanation of these facts, and to look upon that practice as a good one which gets rid of any abnormal condition, local or general. Still, it is wise, when a man has been in the habit of losing by discharge from the surface of a sore a certain amount of material that would otherwise have been used to maintain the general powers, to cut off the supplies in another way, to order more abstemious living, and to regulate the bowels by some saline water, natural or artificial, as may suit the stomach.

Sloughing ulcers.

Sloughing and phagedænic sores are rarely seen, except in connection with syphilis or hospital gangrene. In syphilis, sloughing is found in the intemperate and ill-fed, and mostly in gin-drinking prostitutes. It attacks any surface that has been made sore, either from venereal contact or other cause; it is marked by the rapid way in which the process destroys tissues, the fœtid character of the discharge, the great depression of power invariably present, and the constitutional disturbance.

Treatment of sloughing ulcers.

For their TREATMENT opium in full doses is required, with tonics and good nutritious food. When this does not control the ulceration, the application of the strong nitric acid to the surface of the sore with a piece of wood is often useful; sometimes the local application of iodine or bromine in solution is of great benefit. Fresh air is always indicated, and plenty of disinfectants, such as Condy's fluid, or carbolic acid in some of its forms. These sores are mostly due to some feeble constitutional condition, not to a local cause, although at times the local action seems to continue by itself, and requires some powerful escharotic, such as nitric acid, to check its course.

Paget's description of cold ulcers.

Sir J. Paget describes *cold ulcers*:—"They are like small inflammatory ulcers, occurring spontaneously in the extremities, especially at the ends of the fingers or toes, or at the roots of the nails. In some cases they are preceded by severe pain and small gangrenous spots. They are, in many respects, like ulcerated chilblains, but they occur without any exposure to intense cold in patients whose feet and hands are commonly, or even habitually, but little warmer than the atmosphere they live in. Such patients are among those who say they are never warm, and the skin of their extremities, unless artificially heated, is to the touch like the surface of a cold-blooded animal. With this defect, which is common in women, there is a small feeble pulse, a dull or half livid tint in the parts which in healthy people are ruddy, a weak digestion, constipated bowels, and scanty menstruation.

Treatment of cold ulcers.

"The cure of the ulcers and prevention of their recurrence lie in the remedy of these defects. Many tonic medicines may be useful, but the most so is iron; with it purgatives are generally necessary, *e.g.* small doses of mercury and aloes or of sulphate of magnesia. Full diet also is required, exercise in the fresh air, very warm clothing, especially of the lower half of the body, and warm bathing; dry applications, or lotion of sulphate of zinc or copper, are the best local means, and the part must be kept warm; healing is always tardy at a low temperature."

Allied to these cold ulcers are those that are formed on fingers or other parts which have been deprived of their nerve supply from some injury.

Scorbutic Ulcer.

Busk's scorbutic ulcer.

In Sir J. Paget's able article in 'Holmes's System,' occurs the following description by Mr. Busk, of the scorbutic ulcer:—"Although scurvy in itself cannot be said to be attended with any peculiar form of ulceration, ulcers or sores of any kind already existing from other causes assume, in consequence of this scorbutic taint, a more or less peculiar character, and, when thus modified, have usually been termed 'scorbutic ulcers.'

Pathology of scurvy.

"Scurvy essentially consists in an alteration in the constitution of the blood, which leads to the effusion into the various tissues of a *fibrinous exudation,* usually deeply coloured, and which has on that account been commonly regarded as a simple coagulum. That this effusion, however, can scarcely be regarded in this light, is proved by several considerations, but more especially by the circumstance that it is from the first *solid* and *capable of becoming imperfectly* organized; that is to say, it is after a time permeated by newly formed vascular channels. It is the presence of this effusion which causes the spongy swelling of the gums, the tumefaction and induration of the intermuscular tissue, the so-termed *scorbutic nodes,* and which, when poured out on the surface or in the substance of the corium, constitutes the vibices and petechiæ so characteristic of the disease. It is the *effusion also of the same semi-plastic material on the free surface of sores or ulcers which gives them the peculiar aspect termed scorbutic.*"

Character of the scorbutic ulcer.

"Ulcers of this kind are distinguished by their livid colour and irregular tumid border, around which no trace of cicatrisation is evident, whilst the surface of the sore is covered with a spongy, dark-coloured, strongly adherent, fœtid crust, whose removal is attended with free bleeding, and is followed by a rapid reproduction of the same material. This crust, in bad cases, as remarked by Lind, attains to a 'monstrous size,' and constitutes what has been appropriately termed by sailors 'bullock's liver.'"

The syphilitic superficial sore.

The deep cellular-membranous syphilitic sore has been already described, but the *superficial cutaneous rupial or syphilitic* sore deserves a notice, for it is common. It mostly succeeds an ecthyma or rupia, and is mixed with the eruption in some other stages; it is simply an ulceration of the base of a syphilitic eruption, and this ulceration goes on increasing irregularly in a serpiginous form, the sore in one part healing, in another spreading; it involves only the skin. The edges of the sore, or sores—for they are often multiple—are usually well-defined, and often irregular; the surface is generally of a deep colour; the sore, when healing, may either scab or granulate up, as any other sore. These sores are met with at any period after the first constitutional symptoms of syphilis have passed away, and occasionally at a remote one; they are always found in a cachectic or enfeebled subject; indeed, it appears as if the want of power allowed the disease to crop up again, and manifest its previous existence in the new form.

Period of appearance.

Cellular-membranous ulcer.

THE CELLULAR-MEMBRANOUS SORE appears at a still later date than the rupial, it being by no means uncommon to read in such a sore the specific character of a disease that had been contracted twenty or more years previously, and had lain dormant after having manifested its presence by marked symptoms; indeed, it is from the occurrence of such sores as these that the Surgeon asks the question whether constitutional syphilis is really ever cured—that is, eradicated—and whether a man once syphilized, like once vaccinated, is not so permanently altered as to show, under certain conditions, with comparative certainty, that he is still under the influence of the poison, and that other diseases for ever after must be modified by its existence.

Treatment of the cellular-membranous ulcer.

The treatment of these sores, when once recognised, is not usually difficult. Tonics, with the iodide of potassium in from three to ten grain doses, usually effect a cure, at least for a time; the liquor cinchonæ and compound spirit of ammonia in half-drachm doses are good vehicles. In other cases quinine or iron is indicated. Mercurial remedies are sometimes called for, although rarely; the perchloride of mercury, in doses of $\frac{1}{16}$th of a grain in bark, or the green iodide in one-grain doses in a pill, or the mercurial suppository, being the best forms to use.

Locally, the sores may be dressed with any simple dressing, but when indolent a mercurial lotion, as the black wash, is the best.

On lupus.

Varieties.

Lupus must be classed amongst the ulcers; it has its origin in a skin tubercle, or skin tubercles, of a flat form, fleshy consistence, and pink, shining appearance. When the tubercles remain whole, and simply spread or repeat themselves, the disease is known as the "*lupus non exedens*;" but when they soften down and ulcerate, as "*lupus exedens*."

Characters of lupus ulceration.

This lupus ulceration, when once originated, progresses steadily, and destroys every tissue with which it comes in contact, and when on the nose—its very favorite seat—the whole organ; in this one point simulating cancer. The surface of the sore is sometimes free from all signs of granulations, but often very irregular; it is not painful; its edges are ragged, raised, and often everted; they feel spongy, not so hard as cancer, and not so well defined.

These lupus ulcers are more common on the face than anywhere else, and probably next in frequency on the female genitals; they are most destructive when left alone, but are often very amenable to treatment. They are more common in young adult life than in the old. They are closely allied to tuberculosis.

Treatment of lupus ulcers.

TREATMENT.—Although the disease has probably a constitutional origin, and requires tonic treatment, both by medicine and regimen, there is no disease that derives more benefit from local treatment; and of all modes, the free destruction of the whole growth is the best. Since I have employed the galvanic cautery as a local caustic, I have burnt down many of these lupus ulcers, and even tubercles, and have been surprised to find how rapidly a healthy cicatrix forms; as a caustic this form of cautery has no equal. When it cannot be obtained, the gas or actual cautery may be used, the patient under both circumstances being under the influence of chloroform.

When this treatment is inapplicable, the destruction of the surface by some escharotic should be undertaken, the chloride of zinc paste being probably the best. But whether the galvanic or actual cautery be used, or escharotics, it is essential that the whole tissue be destroyed down to healthy structures. In some cases I have, as it were, scraped or broken down the growth with the handle of a knife, or even cut off the margins, and then applied the cautery to the base of the sore, and the same practice may be followed when caustics are applied. In some cases excision is a good practice, the sore being left to heal.

Rodent and cancerous ulcers will be discussed with the tumours.

BEDSORES.

Bedsores.

In theory bedsores should never occur; but in practice they will, in certain cases, in spite of the greatest care and attention. It is well, however, for the Surgeon to act upon the theory, as by so doing he is stimulated to do everything in his power to guard against their occurrence, and in no instance is the old adage—prevention being better than cure—better illustrated.

Bedsores may briefly be described as the death of a part from mechanical pressure, the parts involved in some cases literally dying from being deprived of their nourishment by prolonged and continued pressure; in others from some inflammatory action induced by it.

Bedsores may take place in healthy subjects who are kept unmoved for ten or fourteen days; but in the old, the fat, or very thin they may occur at an earlier date, as they will in fever cases of all kinds, and in spinal or partially paralytic cases; completely paralysed parts being less prone to slough than the partially.

Dirt and moisture under all circumstances accelerate their appearance.

A bedsore may appear as a simple abrasion, a sloughing of the skin, or subcutaneous tissue, and in severer cases the exposed bone may die, and in the worst the spinal cord may be opened.

Their treatment.

Treatment.—Bedsores being as a rule caused by continual pressure upon a part, they may very generally be averted by some change of the patient's position, and the necessary amount of movement may as a rule be allowed in all medical and in most surgical cases, but local pressure under all circumstances can be periodically relieved.

The skin of the part pressed upon should be hardened by washing it at least twice in the twenty-four hours with some camphor spirit and water, vinegar and water, or nitrous ether and water, in the proportion of one part to three, and at times an artificial covering of the flexible collodion is of great use.

When the parts are about to slough these applications are, however, useless, and nothing but the removal of pressure will suffice; for this purpose, well-filled water beds should be employed and water or air cushions; I have found a mattress divided transversely into three parts and a water cushion substituted for the middle section of great use; at other times the sections of the mattress may be simply separated for a few inches in the line of pressure.

In thin subjects where the spinous processes of the vertebræ feel the pressure, thin strips of felt plaster placed vertically down the back give great relief, and the same plaster applied to other painful parts is of value; cushions of amadou and well-adjusted pads of cotton wool or spongio-piline are always good.

When sloughing is present, a linseed-and-bread poultice with a solution of carbolic acid, Condy's fluid or charcoal sprinkled upon the surface is the best application; but a carrot or yeast poultice at times cleans the wound well.

When the slough has separated some stimulating lotion or ointment may be called for, and this is the best applied on cotton wool.

In all cases where patients have to rest for any time, close attention should be paid to keep the bed smooth and the sheets free from rucks. Corded beds or feather beds should not be used. The best bed is a horsehair mattress placed upon a second or spring bed.

MORTIFICATION, TRAUMATIC, ARTERIAL, AND VENOUS.

Definition.

The mortification of any part of the body signifies its death; when a soft part is "dying," it is said to be in a state of "gangrene;" when "dead," in that of "sphacelus." The dead portion is called a "slough," and the process of separation the act of "sloughing." When a bone is dead, the term "necrosis" is employed; the dead portion being called the "sequestrum," and the process of its separation "exfoliation."

The dead portion of any tissue is separated from the living by means of ulceration; and when the slough has been thrown off, the parts heal by granulation, as an ordinary wound. In the "sloughing phagedæna," the two processes of ulceration and sloughing are combined, the molecular death of a part, or ulceration, going on with the more general gangrene.

Causes.

Direct violence, mechanical or chemical, may be the cause of mortification, either by destroying the vitality of a part at once, or by exciting inflammation in it that induces its death; such cases are called "traumatic." In this group a large proportion of the cases of gangrene are found.

a. Traumatic.

In the second group are found those in which a part is starved for want of supply of arterial blood, the main artery of a limb being obstructed, either from operation, accident, or disease—"anæmic gangrene."

b. Anæmic.

In the third group are classed all those cases in which the stagnation of blood is caused by the mechanical arrest of its venous circulation, with or without secondary inflammatory action—"static gangrene."

c. Static.

In all these groups inflammation plays, directly or indirectly, an important part.

Tissues suffering from defective nutrition, either the result of some want of nerve supply or energy, of extreme debility the consequence of severe illness, or other depressing influence, are more prone to mortify on slight causes than others.

Moist and dry gangrene.

When mortification takes place in tissues that are filled with blood, and more particularly with inflammatory fluids, "moist, hot, or humid gangrene" is produced; when in parts in which no such stasis exists, and where death of the tissues is the result of a want of arterial supply, "dry, cold, or chronic gangrene."

But these two forms are in a measure convertible, the rapidity of the process and the amount of inflammatory infiltration influencing the result.

Direct traumatic gangrene.

Direct traumatic gangrene is well seen in the destruction of skin from the contact of some corrosive acid, such as sulphuric or nitric acid; the black or yellow slough that immediately follows the application of the caustic testifies to its action.

Indirect traumatic gangrene.

Indirect traumatic gangrene is well seen in the integument after the application of a blister to a child or feeble patient, the blister being followed by inflammation of the blistered part, and its subsequent death.

Indirect inflammatory gangrene.

In bad compound fractures the indirect inflammatory gangrene is too often illustrated, the limb swelling rapidly, and the skin becoming of a mottled and livid hue; loose blisters or phlyctenæ of raised cuticle soon form on the surface, containing more or less blood-stained serum, and the tissues become sooner or later cold and insensible, the temperature of the part often falling rapidly. The fluids from the wound, when any are present, soon become offensive, blood-stained and mixed with gas, the tissues crepitating on pressure from its presence.

Line of demarcation.

The gangrene may be local or it may spread upwards, but when the action has attained its limit the living tissues in contact with the dead become highly vascular, and a defined line at length appears, "the line of demarcation;" this vascular line goes on to ulceration, and, if left to take its course, to the separation of the old slough from the living tissues; soft parts, and even bone, may be divided by it, the granulations on the new surface materially assisting the casting off of the slough. The deeper tissues of a limb thus affected rapidly decompose and give rise to a horrible fœtor, the extent of decomposition depending much upon the fluids in the part. Should the limb be exposed, the integument will soon dry and become black, gradually withering, the soft parts beneath undergoing the decomposition of dead tissues.

Rarely attended by hæmorrhage.

This process is rarely attended by hæmorrhage, the blood in the vessels coagulating by the sloughing action and thus obstructing them. In exceptional cases, however, sloughing ensues, the more rapid the sloughing action the greater, apparently, being the liability to bleed.

Direct traumatic gangrene is also well illustrated in cases of extravasation of urine, or fæces, and probably also by the action of some animal poisons.

Examples of anæmic gangrene.

The best examples of anæmic gangrene, *caused by the cutting off of the arterial supply to a part*, are found after the application of a ligature to a large artery, such as the femoral, for aneurism or injury; the rupture of an artery, or its contusion—which often, either by lacerating its inner coats or by other means, is followed by its occlusion—the rare causes of embolic plugging of an artery, and the gradual closure of a vessel from local arteritis or degenerative disease, are also equally typical; and so is the abscess of the brain, or rather sloughing, that follows the application of a ligature to the carotid artery. In all these cases the part dies by starvation from want of blood, and the more sudden the act by which the supply is cut off the greater are the probabilities of gangrene being the result. The sudden occlusion of a large artery, whether in the old or young, is liable to be followed by gangrene. Its gradual occlusion, except in the old, is more rarely followed by such a result, the collateral circulation supplying its place.

Senile gangrene.

In the form of gangrene called "senile" it is very probable that arterial obstruction, the result of atheromatous arterial disease, or of embolic plugging of the vessel from the breaking loose of some portion of the diseased arterial coats, is the immediate cause of the gangrene; but the feebleness of old age, the degeneration of the tissues that have been badly supplied with arterial blood, and often some slight local injury, are doubtless powerful agents in giving effect to the process. One or more of these agents may be the true cause of the gangrene, but they are probably combined in the majority of cases. When the gangrene is purely a dry withering or mummifying process, the cause is probably simply want of blood supply; when inflammation coexists, the gangrene will be moist, the feebly nourished tissues, either from injury or otherwise, becoming inflamed from some accidental cause, and dying.

Gangrene from arteritis or embolism.

In the gangrene met with in the young or middle aged, from arteritis or embolism, the dry form is the usual one, the parts becoming cold, bloodless, waxy, and rapidly withering, turning black and mummifying. When caused by embolism, the onset of the gangrene, or rather the early indication of the plugging of the vessel, is marked by a sudden shooting or crampy pain down the extremity, this symptom being speedily followed by those of "arterial gangrene."

When the occlusion of the vessel is gradual this pain is not present, and the symptoms of gangrene are more chronic.

Gangrene from cold.

The gangrene from "cold" may be the direct result of want of blood supply, or be indirectly caused by the excessive inflammatory reaction that follows, "or secondary mortification." The gangrene following the use of the "ergot of rye" is dry; it follows precisely the course of gangrene from arterial obstruction.

Gangrene from obstruction.

The best illustrations of gangrene *from obstruction—static gangrene*, as it might be called—are seen in strangulated femoral hernia; after the use of splints too tightly applied; after the prolonged employment of the tourniquet to check hæmorrhage; in a tight paraphymosis; in the sloughing of protruding piles; in the gangrene of a limb from the pressure of an aneurism or tumour upon the chief venous trunks, in the sloughing of the legs, groins, or other parts of patients suffering from some obstructive heart disease. In all these cases the parts may die from blood stasis, but inflammation, more or less well marked, with its products, has generally an important influence in producing the result.

Mortification a compound process.

Mortification is thus a compound process, and is brought about by mixed causes—direct injury, want of arterial supply, and blood stasis from mechanical obstruction to the return of the venous blood being the three main exciting causes of the affection. Inflammatory action in each of the three classes of causes thus grouped together has secondarily an important influence; and feebleness of power, old age, want of nutrition or nerve supply in a part, renders a patient or tissue more prone to the action of these causes, and the process more active.

Constitutional symptoms attending gangrene.

The constitutional symptoms associated with gangrene vary with its cause, but under all circumstances a depressed condition of the ordinary powers is to be recognised. In traumatic inflammation during the stage of excitement the pulse may be rapid and the beat strong, the fever high, and other symptoms present indicative of sthenic action, but when about to terminate in gangrene all these symptoms will be marked by a sudden fall, the temperature of the body dropping four or five degrees, from 104° or 105° to 99° F. This sudden fall precedes the gangrenous action, and no better symptom exists to indicate the sudden collapse of the powers of the patient. Some interesting observations on this point by Mr. Pick may be found in 'St. George's Hospital Reports' for 1868.

When the mischief is extensive, and the gangrene spreads, what are known as typhoid symptoms may set in. In the more acute cases death takes place very rapidly, but in the chronic the constitutional symptoms are negative.

Treatment of mortification.

Treatment.—The most important point the Surgeon has to bear in mind in the treatment of every form of mortification is that the condition indicates a depressed state of the system, and that consequently the general treatment should be directed towards maintaining the patient's strength, and cautiously building up the feeble powers by means of nutritious food, stimulants, and tonics; at the same time allaying pain by local and general soothing remedies, such as opium, morphia, or chloral, for nothing depresses more than pain.

Causes to be ascertained.

The cause of the gangrene is next to be considered, for its influence on practice is most important. To treat a case of gangrene the result of a local injury as one due to obstruction of an artery would be clearly wrong, and to deal with an example of this latter form in the same manner as with another due to blood stasis the result of mechanical obstruction to the return of the venous blood of a part would be unscientific. I shall therefore consider this question of treatment as applied to the three groups of cases already formed.

Treatment of traumatic gangrene.

a. When limited.

Treatment of traumatic gangrene, when of a *limited* nature, need cause but little anxiety; it should be treated on ordinary principles of local cleanliness, by poultices, water dressings, or the irrigation of warm water, with some antiseptic lotion, such as Condy's fluid, carbolic acid, chloride of zinc, or chloralum. When the slough has come away the surface is to be treated as an ordinary sore.

b. When extensive.

When more extensive, *but yet defined*, and involving a portion of a limb, whether caused *directly* by the injury or *indirectly* by the inflammation that followed, the expediency of removing the dead part by amputation is not to be disputed. No more of the limb should be sacrificed than is absolutely necessary, and to ensure this object the flaps to cover the end of the stump may be cut of any shape. Thus, in gangrene of the leg it is better to amputate below the knee with any form of flap that can be made of sufficient size than at the joint, and it is far better to amputate at the joint than above it.

c. When spreading.

In "spreading gangrene" of a limb following an injury, however, the difficulties are great. To remove it at once, as soon as the action has declared itself, would be to take away what often might be saved, or to do that which will not arrest the disease; to wait long, too often diminishes the prospects of recovery, and from the extension of the mischief renders the amputation a more formidable one or precludes the possibility of its performance. To amputate when the mortification is rapidly spreading is an unsatisfactory practice, *although to do so when the gangrene is extending from the infiltration of the healthy tissues with the decomposing fluids of the parts is a wise measure.*

Question of amputation.

In a case of local injury such as a bad compound fracture, in which the Surgeon has been tempted to try to save the limb, the first onset of an inflammatory action that assumes a gangrenous form should be met by amputation.

Cases where amputation is useless and otherwise.

Where an injured limb has a good prospect of being made an useful one, an attack of inflammatory gangrene need not necessarily lead to its loss. Where the action is due to the injury the sloughing will probably be local, and may so terminate that a good limb may subsequently be secured. Where the action is due to *general* and not local causes, the amputation of the limb will not arrest it; the same action will in all probability attack the stump and continue till it finds a limit or destroys life; and when amputation is not performed the same limit will be found, or the same end; but with a line of demarcation present amputation may be carried out with a better prospect of success, and if the patient dies the Surgeon will not have helped him to his end. Gangrene from a local traumatic cause may be treated successfully by amputation, but a spreading gangrene, the result of a general or constitutional cause, cannot be thus dealt with, and when amputation is called for, it had better be postponed till the gangrene has ceased to spread, and some line of demarcation has formed to indicate the extent of the mischief.

Opinions quoted.

In making this recommendation it is right to say that it is against what is called authority. Erichsen says, "In traumatic gangrene amputation should be performed as soon as the gangrene has manifested itself, without waiting for the line of demarcation." Spence writes, "In spreading gangrene, amputate without waiting for a line of demarcation." Pirrie says, "As the only chance of life, however slender, lies in immediate amputation, it ought to be performed at once, and high above the part affected." Brodie and Guthrie might be quoted for the same purpose, and H. Coote, in 'Holmes's Surgery,' ed. 2, says, that "the indications for immediate amputation are so clear and generally acknowledged, that he who shrinks from the responsibility of the operation stands exposed to just reproof."

But these authors do not seem sufficiently to recognise a difference between the gangrene due directly to the injury and involving the injured part, and the rapidly spreading gangrene that begins at the seat of injury and travels upwards; the *former* being due to the accident and generally confined to its seat, nature being incompetent to repair it; the *latter* to some inherent weakness in the general power, which the local injury renders manifest.

Rule for guidance.

When the gangrene originates from a local cause, amputation may be the best practice; when it originates from a constitutional one, it had better not be entertained till the action has ceased and a limit to the disease has formed.

In civil practice I believe this rule to be a wise one; in military practice there may be many reasons why it cannot be observed, for all conservative Surgery, or treatment based on expectancy, has to be sacrificed to the exigencies of the moment.

Fergusson is clearly led to this opinion on account of the want of success he has met with in adopting the more usual practice, that of amputation; for when he writes, "I might, however, possibly in future resort to a similar practice, but should feel greatly inclined to wait for a line of demarcation," his opinion must be accepted as being against amputation in spreading gangrene.

Treatment of spreading gangrene.

How is spreading gangrene, then, to be treated? By tonics and local treatment based on general principles; by maintaining the part as free as possible from all fœtid discharges; by local cleanliness and the use of antiseptic applications; but chiefly by using all means at our disposal to give free vent to fœtid discharges and relieve tension, and, when necessary, these ends are to be secured by means of incisions.

Under this practice, when nature is strong enough to check the progress of the disease, a limit to its extent will be formed, and the local affection become amenable to treatment; when no limit takes place, death will ensue, but amputation would not have arrested it.

Local and general measures.

When amputation is called for, on the arrest of the action, the limb should be removed as close above the diseased part as possible. There is no necessity to sacrifice any tissue, and much less a joint, to make the amputation a neat one. The only point for consideration is, that the diseased tissues should be avoided, but beyond these no healthy structures should be sacrificed.

Treatment of anæmic gangrene.

In the treatment of gangrene due to arterial obstruction the objects of the Surgeon are to prevent its extension, and to assist the separation of the parts when called upon.

To carry out the first object, the mortified parts may be wrapped in some lint dipped in oil, with or without carbolic acid, as indicated by fœtor; and the whole extremity should be raised to encourage the venous circulation, and surrounded with cotton wool to maintain its warmth.

Abundance of bland nutritious food should be given, and stimulants with tonics to assist its digestion, and keep up the circulation, but anything like over-stimulating is to be condemned. Opium may be given freely to allay pain, the patient being kept gently under its influence. Where small parts are alone implicated, their separation may be left to nature; but where hands or feet are involved in the gangrene, the Surgeon should assist nature's processes by amputation above the line of demarcation, or about it, as soon as it is indicated.

In senile gangrene

In the "senile gangrene" the Surgeon's interference should be of the mildest kind, but when a limb dies from embolic plugging or occlusion of an artery, or from the effects of ergot of rye, amputation may be performed as soon as the line of demarcation has been indicated, that is, assuming the general condition of the patient to be such as does not forbid it.

Where "sphacelus" takes place after the application of a ligature to a large artery, early amputation is called for, it being wise to remove the limb about the line of ligature, rather than wait for nature to indicate the points; the adoption of this practice saves much constitutional disturbance and economises power.

Treatment of static gangrene.

In the treatment of the third group of cases, those of "static gangrene," caused by the mechanical obstruction to the return of blood from a part, the first thing the Surgeon has to do is to remove the cause. In hernia he does it by dividing the stricture, in paraphymosis by freeing the prepuce; when it is the result of the application of a tourniquet or splints, by their removal, and so on; and if the parts involved are not irreparably lost, a recovery may take place by natural processes, their venous circulation being aided by position and other means.

When gangrene has taken place in a limb from this cause, its early amputation is called for, it being wiser to remove the dead part at once before secondary inflammation sets in, that may spread and cause more loss of tissue; the seat of the mechanical force fairly indicates the extent of mischief.

In gangrene of a limb from a ruptured artery or aneurism the same practice should be followed for like reasons; delay, under all these circumstances, being as unnecessary as it is injurious.

HOSPITAL GANGRENE,

Causes.

Or sloughing phagedæna, is an affection that attacks wounded or injured parts, and mostly in hospitals that are over-crowded, badly ventilated, and ill drained. At times it would appear as if generated in a ward too closely filled with patients who have suppurating wounds, at others as if conveyed into a ward by the introduction of of a sloughing or fœtid sore. Want of cleanliness in the treatment of suppurating wounds, and want of attention to sanitary laws, have undoubtedly much to do with its propagation, for the disease seems to be contagious through its discharges, and infectious. Its contagious character is admitted by all, but some dispute its infectiousness. Guthrie, however, relates in his 'Commentaries,' the following striking fact bearing upon the point:—"Burgmans says, that hospital gangrene prevailed in one of the low wards at Leyden, in 1798, whilst the ward above it was free. The Surgeon made an opening in the ceiling between the two, in order to ventilate the lower or affected ward, and, in thirty hours, three patients, who lay next the opening, were attacked by the disease, which soon spread through the whole ward."

Two forms: *a.* Ulceration.

Two forms of the disease seem to exist. In one the ulcerative action is the more violent; wounds attacked with it rapidly spread; skin, subcutaneous and connective tissues all disappear under its action, and small sloughs take place at the same time. Blackadder relates how a vesicle forms and ulcerates, the ulceration rapidly spreading, leaving a sharp well-defined edge to the ulcer. This form of the affection Delpech designated "ulcerous" and Boggie "phagedæna gangrenosa."

b. Sloughing.

In the second form the tissues die in masses, forming pale, ash-coloured, pultaceous, horribly offensive sloughs; these sloughs gave the old term "putrid degeneration" to the disease. In one epidemic the ulcerative form will predominate, in another the sloughing, and at times it appears as if one form of the disease will give place to the other.

Characters.

Local conditions.

An open wound, as a rule, seems a requisite for the affection to fix upon, but not always, for, in 1849, when the wards of Guy's Hospital were *last* filled with such cases, a contused part often took on the action, the affection commencing as a vesicle, its base turning at once into a greyish slough, which rapidly extended. When the affection attacked a wound, its edges or surface would cease to secrete; then turn of a grey colour, as a slough; and this slough would spread, small wounds becoming large ones even in twenty-four hours. When the slough had ceased to spread, ulceration would begin to throw it off; and the fœtor of the slough, and the *débris* of the ulcerating tissues, formed a mass of decomposing material unequalled in any other affection. Skin readily died under the influence of the process on the connective tissue; but muscles became likewise involved; tendons and vessels gave way only in prolonged cases, hæmorrhage being rare; the parts around the wound showed small signs of change till the sloughing had ceased and ulceration had commenced, when the line of separation would be indicated by a red zone.

Constitutional symptoms.

The constitutional symptoms of the epidemic I have described and witnessed were negative; there were certainly none to indicate the approach of the action; no fever, no disturbance indicative of over-action; and when the local symptoms had manifested themselves, great depression was very general. But it was always to be remarked that the constitutional symptoms were never in proportion to the extent of the local affection. When strong subjects were attacked the local mischief told but little upon their powers; with feeble subjects the effects were more marked.

Military surgeons have, however, related how the constitutional symptoms often preceded the local. Hennen states this very clearly; and Thomson, of America, found the same; but Blackadder, Delpech, Guthrie, and Macleod found the local affection took precedence in point of time.

It would rather appear, from the descriptions given of the different epidemics at various times, that the ulcerative form is more commonly preceded by constitutional symptoms than the sloughing; the sloughing being, apparently, a local affection at the first.

Billroth on diphtheritic infiltration.

During the late German campaign Professor Billroth met with a wound disease, which he had not seen before, and which he terms "diphtheritic phlegmon," or "diphtheritic infiltration." He relates three cases in which the diphtheritic appearance occurred soon after operations, and was speedily followed by fatal collapse. The entire muscular structure of the part becomes hard and stiff, from an indurated infiltration, the surface of the wound being of a pale grey. The affection is especially distinguished from gangrene by an absence of any rapid increase of the ulcerative process or of inflammatory redness in the vicinity; the surface of the wound exhibiting a lardaceous whiteness, and not the greasy pulpousness of hospital gangrene. The broad, hard infiltration so soon following the operation, might seem to be due to contagion, by means of the dressings employed, but this is hardly probable. In its sporadic form it seems especially to affect the subjects of septic or pyæmic disease, and perhaps the existence of a certain condition of the secretions inclined to coagulation may favour its production.

Treatment of hospital gangrene.

TREATMENT.—Before all things *abundance of fresh air* is most essential even to an air bath, as maintained by a constant current allowed to pass through the ward or room. The separation of the affected from the healthy, the free use of such antiseptics as may be fancied, and close attention to all sanitary measures should be scrupulously observed. During the early stages of the disease irrigation seems to be the best local treatment. *No sponges should ever be employed.* The next object is *to take away all sloughs and putrescent material*, and this must be done by carefully cutting away the existing slough with scissors or scalpel aided by the dressing forceps, and mopping of the surface of the wound with cotton wool or tow; *the whole surface of the wound being thoroughly cleansed.* The third aim is to prevent the extension or return of the sloughing by local applications.

Local measures.

Of these applications nitric acid was formerly the chief one, the acid being freely applied all over the diseased parts, and carefully introduced into every hollow and excavation into which it could percolate.

To apply the acid, writes Welbank, "the sore must be thoroughly cleansed, and all its moisture absorbed by lint or tow. The surrounding parts must next be defended with a thick layer of ointment; then a thick pledget of lint, which may be conveniently fastened to the end of a stick, is to be imbued with the acid, and to be pressed steadily on every part of the diseased surface till the latter is converted into a dry, firm, and insensible mass. The part may then be covered with simple dressings and cloths wet with cold water."

Dr. Goldsmith, of America, has spoken very highly of the value of bromine as an applcation, this drug arresting ulceration and turning sloughs into tough deodorized tissues, and he and others have brought forward sufficient evidence to prove its value; it should be applied as the nitric acid, freely to the whole surface, its application being repeated again and again when the sloughing or ulceration spreads. Iodine and the oil of turpentine have also their advocates, the latter, it is said, having the power to dissolve out the sloughs and change the action of the disease. Delpech and other surgeons speak highly of the actual cautery, and when the galvanic cautery is to be had it may be used, the object of all these different plans of treatment being to excite a new action on the surface of the wound, and to destroy the sloughing tissues which, doubtless, by mere contact have a power of keeping up or propagating the affection.

When the sore is extensive chloroform should be administered during this local treatment. After the cauterization the surface of the sore may be dressed with the permanganate of potash, carbolic acid, or iodine lotion, opium being added to allay pain; bromine in solution, two drops to the ounce of water, is also good.

Dr. Packard, of Philadelphia, prefers the use of powdered sugar or thick syrup, sugar being a hydrate of carbon which does not give up its oxygen, and well known for its preservative powers in the case of meats. He dusts the parts with the sugar, and covers the whole with wet lint. When odour exists charcoal may be mixed with the sugar.

Constitutional treatment.

The constitutional treatment consists in abundance of light, nutritious food, milk being given as freely as it can be taken, with sufficient stimulants to maintain the circulatory system and assist digestion.

Tonics, such as quinine and iron, are often well borne in large doses, five grains of the former dissolved in half a drachm of the tincture of the perchloride of iron being a good recipe, or when quinine cannot be taken the tincture of nux vomica in ten-drop doses may be substituted.

Opium is an admirable drug when the ulcerative action is present, but in the sloughing stage it is not so well borne; to allay pain and give ease it may be given in any of its forms. Chloral is probably a good drug for the same purpose.

ERYSIPELAS.

Definition.

Erysipelas is a specific disease, due to the presence of some blood poison that has probably been introduced into the body from without; it is intimately allied with other blood poisons, such as are found in scarlet or puerperal fevers, or septicæmia in any of its forms; for these poisons seem to be convertible. It is not so much a hospital disease as is generally believed, 130 cases out of 224 treated at Guy's Hospital within three years having been admitted with the affection, and some of those recorded as having been transferred from one of the wards simply passed through it.

Not hospital disease.

Varieties.

It manifests its presence in three ways:—As a diffused cutaneous inflammation, "simple cutaneous erysipelas;" as a diffused inflammation of the cellular tissue, "diffused cellular inflammation;" and as a diffused inflammation of both skin and cellular tissue combined, "phlegmonous erysipelas;" the two latter forms together being included in the expression "cellulo-cutaneous." The state of the system, the temperament and habits of the individual, have much to do in determining the form of the affection; and whether the disease follows an injury, when it is called "traumatic," or occurs spontaneously. when it is styled "idiopathic."

Its essential characters.

The peculiarity of erysipelas lies in the diffused character of the inflammation, and in its atonic nature. It is both *infectious* and *contagious*.

Symptoms.

a. Constitutional.

The attack is at times preceded by some constitutional disturbance, but as often as not no such has been observed, the severity of the general symptoms in no way bearing any proportion to that of the local disease. Febrile symptoms, ushered in by chilliness and *rigor*, are the most usual, the tongue being probably a foul one, and the bowels constipated or relaxed. As the disease advances the fever may run high; delirium of different forms may appear, and the pulse be quickened, but if full it will always be compressible, and often irregular or intermittent; towards the close of the disease, particularly when terminating badly, the pulse will be small and weak.

Nunneley, H. Bird, and C. de Morgan assert that if the pulse rise in frequency after the sixth or seventh day it is a very bad sign. I cannot say I have observed this, although, as this is about the time that complications appear when they occur, it is possibly the case.

Premonitory affection of cervical glands.

Frank has pointed out that when a patient has had febrile symptoms for some hours, attended with pain, tenderness and swelling of the lymphatic glands of the neck, he has no hesitation in determining that erysipelas is coming on. Chomel held the same view, and Campbell de Morgan relates "that Busk is so convinced of the invariable occurrence of affection of the glands before erysipelas appears, as to consider it a pathognomonic symptom, and he believes that, although the blood becomes affected, the actual primary seat of the local inflammation is in the absorbent system. Sometimes swelling and excessive tenderness of the glands precede by many hours the appearance of a blush on the skin. These views accord well with those which Dr. Bastian brought before the Pathological Society in 1869, based on the post-mortem examination of a man who died from erysipelas in a state of delirium and stupor. In this case he found the small arteries and capillaries of the brain plugged with embolic masses of white blood-corpuscles, and suggested this condition as the cause of the delirium. He stated "that the blood change is a general one, and through every part of the body this blood is carried with its rebellious white corpuscles, so that we may expect that in all organs alike the same obliterations of small arteries and capillaries take place." Thus, when those of the liver are involved jaundice may be produced, and when those of the kidney, albuminuria, these conditions being occasionally found in erysipelas.

Dr. Bastian's views.

Capillary embolism.

If pathologically we accept Dr. Bastian's observations, and look to the conduct of the white blood-corpuscles for an explanation of many of the phenomena of erysipelas, we are fairly disposed to accept the clinical observations respecting the absorbent system to which Frank and Busk have called our attention, for the glands of this system and the white blood-corpuscles are generally recognised as having a close relationship. All these observations, however, require confirmation before they are accepted.

b. Local symptoms.
In mild form.

Local symptoms.

In the *simple* form of cutaneous erysipelas mere excess of vascularity, as indicated by the vivid redness of the part affected, is the one local symptom, this redness rapidly spreading. A sensation of heat or tingling in the part may be present, and, in rare instances, small vesications. On pressure with the finger the redness will disappear, to return directly the pressure is removed, but there will be no pitting of the parts to indicate œdema. In a day or two these symptoms will subside or disappear, the cuticle desquamating.

In severer form.

In the *severer* form of cutaneous erysipelas the vascularity of the skin will be as intense as in the simple, but it may be more livid. It will be associated with some perceptible thickening of the parts, the inflamed tissues feeling raised on palpation. The inflammation will spread rapidly in one or other direction, sometimes occurring in patches, these patches joining. Where much cellular tissue exists œdema will rapidly show itself, as in the eyelids or scrotum. Small or large vesicles form on the surface, containing either a clear serum or a blood-stained or sero-purulent fluid, this latter form being indicative of great depression.

In the head or other parts, where the skin is tight, the feeling of tension is very great, and the surface looks shining, the features being altogether obliterated. There is rarely, however, much pain, The border of the inflammation is invariably well defined.

Course and duration.

This disease runs its course in about ten days; for the first three or four it spreads, and, having reached its height, declines, the redness and swelling gradually subsiding and the skin desquamating. In some cases a local suppuration takes place, and this is always to be suspected when any local redness remains after the subsidence of the inflammation. In the eyelids and other parts containing loose cellular tissue this result is common. In the cachectic subject the disease is always more œdematous than in the healthy. When this affection attacks a wound the general symptoms are the same, but the local are, first, arrest of secretion in the part and then ulceration; where union has existed, disunion appears, stumps and wounds sometimes reopening and discharging a thin ichorous fluid.

After the disease has subsided repair is usually slow, but, at times, it goes on healthily to a complete recovery.

Prognosis.

Simple erysipelas, unless in the feeble or cachectic, is rarely a disease of much danger. When it attacks the scalp after head injuries it is exceptional to find it followed by bad consequences. In free living subjects, and in others who have bad viscera, it is a dangerous affection, lighting up latent disease that often proves fatal.

Where the erysipelas attacks the mucous lining of the throat, fauces, or larynx, it may, from mechanical causes, threaten life.

In some cases the disease will affect different parts of the body consecutively, or leave one spot suddenly to attack another. Such cases usually indicate want of power, and are too often found in subjects who have some organic disease of the kidney or other excretory organ.

On diffused cellular inflammation as a form of erysipelas.

Diffuse cellular inflammation may clinically be looked upon as a form of erysipelas, the disease attacking primarily the cellular tissue instead of the skin. It is characterised by the same diffused form of inflammation and by the same atonic character. It is, however, more commonly the result of some local injury such as a punctured or dissection wound than is the simple form, but it is found in patients from whom no such history can be obtained. It is almost always associated with absorbent inflammation and glandular enlargement.

Local symptoms.

The disease appears as a diffused swelling and induration of the cellular tissue of the part affected, the tissues feeling infiltrated and brawny, and the skin being tense from over-distension. When suppuration or sloughing of the cellular tissue has taken place, fluctuation will he felt or crepitation, the parts often feeling boggy. The skin, if not previously inflamed, will now participate in the disease; it will inflame and ulcerate or slough, to allow of the escape of the pent-up pus or sloughing cellular tissue. When resolution takes place at an early period of this affection, the skin may escape uninjured, but this result is rare.

Constitutional.

The constitutional symptoms attending these changes in the cellular tissue are always those of great depression. The febrile symptoms will be of the typhoid type, the pulse feeble from the first, although rapid, and the disposition to sink very marked. Profuse sweating is an early and a constant symptom. Delirium is often present, and visceral complications are, as a rule, the cause of death, the connection between this affection and septicæmia being very close.

On phlegmonous erysipelas.

Phlegmonous erysipelas is a combination of the two former; it is far more serious than the simple, and as serious as the cellular inflammation. It is characterised by a diffused inflammation of the skin and cellular tissue together, the parts having a strong disposition to suppurate and slough. Resolution is almost an unknown termination of the disease, one case differing from another only in the extent of the destruction of tissue with which it is accompanied. It is commonly the result of some punctured wound or injury involving the skin and cellular tissue beneath. It begins locally as a brawny infiltration of a part, the skin presenting the ordinary erysipelatous redness, but of a dusky hue; to the finger the parts will feel more solid, and will pit on pressure; the boundary between the inflamed and uninflamed skin will be less marked, and outside the limit of the redness the skin will feel firmer than natural, and the cellular tissue beneath as if infiltrated.

Local symptoms.

Progress of phlegmonous erysipelas.

As the disease progresses, and the cellular tissue beneath the integument becomes infiltrated with inflammatory products, the skin will be made tight from tension, and will cease to pit on pressure; uniform hardness of the tissues will give place to a sense of fluctuation, as of fluid, or to a boggy, quaggy, crepitating feel of sloughing cellular tissue.

Sloughing of tissues.

If the case be left to nature, the skin will thin and ulcerate in parts, or slough in masses, to give vent to the pent-up and sloughing tissues. Phlyctænæ appear over the dead portions of skin as in other forms of gangrene, while the pus and sloughs that escape are always fœtid. In bad cases the whole cellular tissue of a limb, with large portions of integument, may in this way die, bands of skin, held down by fascia, being commonly left, which on recovery will become the centres of cutification.

In the ordinary run of cases this diffused infiltration of the cellular tissue is confined by the fascia to the subcutaneous tissue; but in some instances, when the cellular tissue that separates the muscles becomes involved, the case assumes a far more serious aspect, for the suppuration is then of a burrowing kind, the sloughing is far more extensive, and the prospects of a recovery, with an useful muscle, becomes very slender; for muscles and tendons may not only slough wholly or in part, but on recovery taking place they become so closely bound together with all the other tissues as to be useless as moving organs. From this cause after phlegmonous inflammation of the hand and forearm, a stiff and immovable extremity is often met with, the hand becoming a kind of fin.

Severity of constitutional symptoms.

The constitutional symptoms attending phlegmonous erysipelas vary considerably, their severity depending much upon the rapidity with which the disease spreads. They are, however, in character the same as are found in other forms of the affection, but probably more severe. The rigors are more marked, the fever is higher, and the pulse more rapid, the tendency to fall in power being always marked. Thus, in the second stage of the disease—the suppurative or sloughing—the rigors frequently recur; cold sweats and fever intervene as in an ague, these attacks being indicative of suppuration. When the local affection is undergoing repair, or, at any rate, has ceased to spread, and these " false ague fits " persist, some internal or visceral complication may be looked for, the blood becoming poisoned as in septicæmia, often to the destruction of life.

Pathological appearances found in erysipelas.

The pathological appearances met with in cases of death from erysipelas have been kindly drawn up for me by Dr. J. F. Goodhart, after a careful analysis of the post-mortem records of the hospital. They admit of the classification local and general. The *local* will include all those morbid changes which occur in the primary focus and in the surrounding parts directly extending from it; the *general*, the various alterations of blood or tissue found in any secondary foci or the system at large.

Local.

The *local* changes vary according to the severity of the disease and the rapidity with which it causes death.

In the slighter forms, where it has not been the immediate cause, but has come on as an intercurrent affection in the course of some other disease, it may often be that no morbid appearance is visible postmortem to give evidence of erysipelas. Again, the skin alone may be affected either with a mere faint purple discoloration or slight œdema, or the cuticle is raised into bullæ or separated more or less around. In more pronounced cases the areolar tissue beneath the skin and along the tendons and intermuscular septa has numerous minute ecchymoses and extravasations of blood in it, and is often soaked with yellow serum or gelatinous matter, apparently produced by a delicate fibrinous coagulum; in the more prolonged or in severe cases the serum is replaced by good-looking pus. Ecchymoses in the subcutaneous areolar tissue are very common even in cases where death has been very rapid and no other morbid appearances are seen.

It is characteristic of the further changes that there is no tendency to the limitation of the extension of the disease around the primary focus; the pus or serum leads to the formation of no abscess sac, but spreads along the subcutaneous tissues and intermuscular septa, sometimes even going to the extent of making a complete dissection of some of the muscles.

Local.

There may or may not be phlebitis in the parts. If there be, the interior of the veins affected is discoloured and filled with a grumous chocolate-coloured fluid, while the inner surface of the vein wall is rough from the inflammatory processes it has undergone and the adhesion of small particles of clot. Where the disease has existed some time a tube of semi-organized clot may line the vein, and within that comes the broken-down clot which it is often impossible to distinguish microscopically from pus.

It is, however, quite as common, if not more so, to find the vessels unaffected as to find them plugged. Pus may even run along their course, sometimes apparently in their adventitia, and generally immediately outside it, and yet lead to no clotting. On microscopical examination the pus in these cases is seen to lie in smooth-walled channels, which are in all probability lymphatic spaces (suppurative lymphangitis).

The neighbouring lymphatic glands, *i.e.*, those in the groin if the disease be situated in the leg—the axillary, if it be in the arm, &c., are usually swollen, red, and ecchymosed on section, and they are frequently surrounded by the same serous fluid found in the immediate neighbourhood of the primarily diseased tissue. The tissues of all diseased parts are said to be crowded with small vegetable organisms called bacteria. These constitute the local changes. It may perhaps be as well to add, when erysipelas affects the scalp, a yellow colour of the vault of the skull is often observed and that suppuration between the bone and dura mater and suppurative arachnitis and meningitis are not very unusual sequences. About the neck it may be followed by œdema glottidis, and occasionally by pericarditis or suppurative inflammation of the mediastinum.

General.

The morbid appearances in the system at large are similar to those found in septicæmia from other causes, viz., ecchymoses about the pleura and pericardium; a fluid and sometimes treacly state of the blood, congested kidneys, and a softened state of the liver and spleen. So soft, indeed, is the latter organ that were it not for its capsule it would at times lose all shape. The blood is said to contain bacteria, but I have never found them during life, though they are sometimes present when the blood is examined some hours after death. In addition to these *general* changes we sometimes find separate foci of diffuse cellulitis,—in both forearms and in the calf of the leg, for instance, after a primary erysipelatous state of the scrotum—and in at least two recorded cases a similar diffuse cellulitis or myocarditis has been noticed in the muscular wall of the heart. Cases of erysipelas are also liable to suppurative peritonitis and pleurisy, which, though commonly so, are not necessarily determined by the presence of a neighbouring wound. A case of hernia or ovariotomy at a time when erysipelas is rife will likely enough die of suppurative peritonitis; an excision of the breast of a similar form of pleurisy without showing any external evidence of erysipelas.

But a wound is not necessary. For example, to take a post-mortem made not long ago. A lady about 60 had been nursing a friend who died of some febrile affection called “ low fever.” Within a few days she herself became exceedingly ill and quickly died. The inspection revealed what had only been evidenced by the faintest blush on the skin during life—an early suppurative inflammation of the cellular tissue of the right axilla and pectoral region, and pus on the surfaces of both pleuræ, and this without any external wound whatever.

As occasional causes of death in erysipelas may also be mentioned acute lobar pneumonia, and a diphtheritic sloughing of the mucous coat of parts of the bowel; while to complete the history, it must also be said that at times when erysipelas is present in an hospital or its neighbourhood, not only are cases of pyæmia with the known manifestations, abscesses in the viscera and pus in the joints, frequent, but also cases of chronic suppuration become feverish and die without, it may be, any adequate cause to show in the viscera.

In this description of the pathological appearances found in erysipelas I have not attempted to distinguish between it and cellulitis. The morbid changes in the two are the same, and it is as impossible in the deadhouse as at the bedside to separate the two.

Treatment of erysipelas.

Support the powers.

Treatment.—The disease in all its forms being essentially an *atonic* one, nothing like "antiphlogistic" remedies are to be entertained, and in the simpler forms which have a tendency to run a definite course, the practitioner has merely to guide his patient through the attack, and to ward off whatever might prove injurious. When the patient's powers are good, and no indications of feebleness manifest themselves, a mild aperient or purge, to clear out the bowels, and bland nutritious food, such as milk and beef tea, are probably sufficient remedial means, the disease, on the third or fourth day, attaining its height, and then declining,

Tonics.

Should any feebleness or want of power appear at the beginning or during the course of the disease, tonics are indicated, and of all tonics iron seems to be the best. The tincture of the perchloride in half-drachm doses, or more, frequently repeated to an adult, with or without quinine or strychnia, acts at times like a charm. The use of iron was introduced to British surgeons by Dr. H. Bell, of Edinburgh, in 1851, and stands unrivalled, although Velpeau, in 1841, had previously declared its value. It doubtless often cuts short the disease.

In the earliest stage of the affection, when the first patch of inflammation has appeared on the skin or around a wound, an emetic may at times cut short the attack.

Stimulants.

When food cannot be taken, stimulants must be substituted, and it is often possible to introduce into them, and particularly into stout, some essence of meat. The form of stimulant must depend upon circumstances, but, as a rule, the one the patient has been in the habit of taking is the best. When brandy is given it should be mixed with milk or eggs, it being always well not to give stimulants alone. The amount of stimulant must be regulated with care; over-excitation of the system is always bad.

Sedatives with caution.

Hypnotics or sedatives must be used with caution, for they are not usually well borne. Chloral seems less liable to disagree than opium; camphor and henbane in five-grain doses, are thought well of by some as a sedative, and ammonia is highly recommended by others.

In phlegmonous and cellular erysipelas the same principles of practice are applicable, and in the suppurative or sloughing stages the necessity of giving abundance of good food of all kinds, and stimulants in proportion, is essential, strong animal broths and milk being the best forms.

Local treatment of erysipelas.

Local Treatment.—The inflamed parts should always be kept warm and raised, and air should be excluded from the surface; consequently, when the head and face are implicated with simple erysipelas, the old practice of flouring the parts is not a bad one; where warm

In simple form.

fomentations can be applied they are the best, poppy, hop, or chamomile decoctions being used; cold applications are injurious.

In the face and head, when the parts are very tense and painful, relief is readily given by following the practice of Sir R. Dobson, and puncturing the skin with a series of small punctures, oozing of blood or serum being encouraged by warm applications.

Mr. Luke used to think highly of the free use of collodion, applied over the part; Mr. Norris, of the compound tincture of iodine; Mr. Higginbottom, of a solution of nitrate of silver, twenty grains to the drachm of water; others, of the sulphate of iron a drachm to a pint. The tincture of the perchloride of iron has been used for the same purpose. I have employed at times all these things, likewise a mixture of iron and glycerine, but none of these applications have any certain power of arresting the progress of the disease; in some cases success seems to attend their use, but in others they appear valueless. Some American surgeons, however, speak strongly in favour of the application of a solution of bromine on lint, with oil-silk over the whole, and quite recently the subcutaneous injection of a solution of carbolic acid has been highly spoken of. Mr. De Morgan thinks there are not many things more comfortable to the patient than a thick layer of cotton wool placed over the part, to which powder or collodion has been applied; it is more soothing than fomentations.

Local treatment of cellulo-cutaneous form.

Incisions.

The local treatment of the cellulo-cutaneous forms of the disease must be conducted on the same principles as the simple, but as soon as anything like tension of the integument appears—this tension being clearly caused by the presence of inflammatory exudation in the subcutaneous tissue—incisions should be made deep enough to allow of the escape of the effused serum from the cellular tissue beneath the skin, and long enough to relieve the tension of the whole. Some Surgeons recommend the incision to be a free one, so as to extend the whole length of the affected part; the late Sir W. Lawrence advocated this. Others, amongst whom I must claim a place, prefer a greater number of limited incisions. The limited incisions answer the same purpose as the long, and are not attended with so copious a hæmorrhage, or with so great a risk to life. Even after these the bleeding is at times profuse, but it may generally be readily arrested by elevating the limb and by temporary pressure.

Relieve suppuration.

When suppuration and sloughing exist the Surgeon must let out all matter as soon as formed, for there is little doubt that the disease is kept up by its presence. The openings into these abscesses should be free, and their cavities kept clean by careful washing out at each dressing, a detail which adds materially to the comfort of the patient and the well-doing of the case. Condy's fluid is as good a lotion to use as any other. De Morgan prefers a solution of chloride of zinc, fifteen grains to the ounce. Water dressings should be applied to the parts, and frequently changed, a warm fomentation over the lint being often useful. Poultices are not so good, although at times patients say they derive the most comfort from them. During the period of repair the Surgeon will often have to lay open sinuses. When the sloughing has been very severe amputation may be called for. It should always be borne in mind that erysipelas is a highly contagious and infectious disease. In hospital practice, consequently, every case, as it arises, should be separated from others in which wounds exist, and transferred

Avoid communicating the infection.

Isolation and fresh air.

to a separate ward. All dressings and towels as they leave the ward or chamber should be burnt or disinfected; a sponge should never be used. Plenty of fresh air should be admitted to the room, but no draught; and disinfectants should be freely distributed about. No medical practitioner should under any circumstances go direct from a case of erysipelas to a midwifery case. Should he be obliged to attend a labour when in attendance on such a case, he should allow as much time as he can to pass before he does so, and should attend then only after having changed his clothes and carefully disinfected his hands, for there is a direct connection between erysipelas and puerperal fever.

ERYTHEMA.

Erythema.

Erythema finds its place here, as in its clinical features it bears some resemblance to the simple cutaneous erysipelas, and has been mistaken for it. It appears as a roseate or more vivid injection of the skin, of a local or general character, disappearing on pressure, and accompanied with some slight degree of œdematous swelling.

When transitory.

In its mere *transitory* form, when it appears as a cutaneous hyperæmia, it may be regarded as a symptom of some bowel or intestinal irritation, induced by irregularity in diet, or other cause; in so-called bilious subjects it is by no means uncommon, a local patch of redness on some part of the face, or other part of the body, often indicating the approach of a "bilious attack;" it is found, also, where organic disease of the intestines is present. In other cases it precedes an attack of smallpox, attends vaccinia, and is common in children.

Hebra gives the term *erythema fugax* to all these symptomatic forms of erythema.

Erythema as a disease.

Erythema, as a *disease*, more commonly attacks the extremities than the trunk, and the dorsal surfaces in preference to other parts. When the efflorescence appears in small patches of papules or tubercles upon the fingers or hands, the terms *E. papulatum* and *E. tuberculatum* are respectively given.

Varieties.

Wilson and Hebra on erythema.

When these patches assume the form of a red ring, the term *E. annulare* is applied to it. When a second ring forms round the first, before it has passed away, or when it is represented by a small spot, the *E. iris* is formed; and where many such circles or half-circles appear together, and touch or coalesce and spread, the *E. circinatum* and *E. gyratum* are respectively present. Wilson mentions a case in which the *E. gyratum* covered the whole body; but all these different forms of erythema must be regarded as different stages of the same disease. Hebra says, "it will depend on the period at which the patient comes under medical observation whether the case shall be diagnosed as *E. papulatum* or *E. gyratum*." He gives one term to the whole, *E. multiforme*. As the disease subsides, a slight desquamation follows, and some small deposit of pigment. Mr. Morrant Baker describes an *Erythema serpens*, that follows a slight, probably poisoned abrasion, and spreads in a circular manner, leaving the injured part well; it generally occurs in the hand. ('St. Barthol. Hosp. Rep.,' vol. ix.)

Treatment.

All these forms run a definite course, and have a tendency to get well; they last from one to three or four weeks; they require for treatment little else than attention to the diet and bowels, correcting anything that appears wrong.

Erythema occurs at times during the secondary stage of cholera.

The erythema that precedes or accompanies an attack of elephantiasis is worthy of notice.

Erythema nodosum.

Characters.

Erythema nodosum, however, is a more definite affection; it is found in both sexes, but in the female the more commonly; it is also usually seen upon the legs, but not rarely upon the arms and other parts of the body. It shows itself in raised and tender patches of very variable size, of a red colour and oval form; some may be the size of a sixpence, others that of an orange; but when they run into one another, they still maintain their distinctness. At first they are of a bright red colour, but as they die away they become of a livid hue and appear very like a bruise, fading away through a yellow stage. The cuticle always desquamates. When the disease is limited there may be no constitutional disturbance, although occasionally some febrile symptoms appear, and there is usually some evidence of derangement of the digestive organs with a foul tongue. As often as not, however, the local disease is the first symptom that attracts attention. The eruption is often symmetrical. When it appears over the shin and the skin is very red and painful, it is not unusual to find it mistaken for some more serious affection, such as periostitis; but the absence of severe constitutional disturbance, such as commonly attends this affection, ought to prevent any error. The history of the case is enough to distinguish it from a bruise; and the different centres of redness or congestion from erysipelas.

Treatment of erythema nodosum.

The *treatment* of this disease is simple. Saline purgatives, tonics, and a carefully regulated diet are, as a rule, sufficient.

The application of a lead lotion to the inflamed part, with elevation of the limbs, is generally all the lócal treatment required; but in exceptional cases warm fomentations, with or without poppy decoction, give greater comfort.

ON TRAUMATIC FEVER, SEPTICÆMIA, AND PYÆMIA.

Definition.

Inflammatory fever, surgical, suppurative, or traumatic fever; septicæmia, ichoræmia, puerperal fever, and pyæmia, may all be considered as so many different names for, and manifestations of, one condition—*blood poisoning.*

In inflammatory and surgical fever "the returning fluids of the inflamed part, its venous blood, and its lymph, are the agents of general infection" (Simon), the poison being probably derived from disintegrated tissues and generated from within the body; the poisoning being "due to the introduction into the torrent of the circulation of toxic substances produced by the organism itself." (Maisonneuve.)

In septicæmia, ichoræmia, puerperal fever, and pyæmia, the absorption of putrid inflammatory products, whether from a wound or otherwise, of pus or pus-forming material, or of some other poison, is the undoubted cause; the poison under these circumstances being taken into the body, either by the veins or by the absorbents from without. Traumatic or surgical fever may, however, pass into septicæmia, and this into pyæmia, the first being the mildest form of blood poisoning, the last the most severe; the one generally ending in recovery, the other, by the formation of secondary abscesses, either within or without the cavities of the body, in death.

Symptoms of blood poisoning.

One and all are ushered in by very similar general symptoms, and an outline of those met with in a typical example of inflammatory fever will be found in a former page; "but practically the affection shows numberless grades and differences and complications. First, there are wide differences of degree and character, for in proportion as the local process is less acute and less extensive there is less attendant febrility; and in proportion as the local process has to invade fewer successive strata of texture, the fever is of shorter course. On the one hand, it may be so slight as readily to escape notice, and may end within a few hours of its commencement; on the other hand, it may last in full force during many successive days, and may be so severe as to shake the patient's life to its foundation; and, besides these differences, there are varieties of result, sometimes from complicative local conditions, sometimes from peculiar susceptibilities of the patient. If the wound become the seat of some large textural disorganization, with consequent soakage of putrefying material, more marked signs of *blood pollution* may be expected to mix with or supersede those of common inflammatory fever; the patient's general state will then incline to be one of depression and apathy; his tongue will be more than commonly foul, and fœtid diarrhœa will probably exist; or if, perchance, during the local process, it happen (as is especially apt to be the case where cancellous bone-structure is affected) that pus passes up a vein into the general stream of blood, the patient's improvement is abruptly cut short by the *severe recurrent rigors and sweating of pyæmia*, accompanied by local signs of secondary suppuration in parts to which the pus is conveyed." (Simon.)

Its characteristics.

Confirmed blood poisoning, therefore, is characterised not only by all the symptoms of inflammatory fever, but by *severe rigors* breaking in upon the febrile symptoms; by *sudden and marked variations of temperature*, by *profuse sweats and great depression of the patient's powers*; and when these symptoms occur in the course of an attack of inflammatory fever, severe blood poisoning is certainly indicated; the gravity of the attack being measured by the intensity of the symptoms. We generally meet, moreover, in pyæmia with local signs of inflammation of some internal or external part of the body, this inflammation running on to the formation of *metastatic or secondary abscesses* as they are called. When an internal organ is involved in this disease the result is as a rule fatal. When suppuration attacks the integuments or extremities, although it may be severe, there is always a good hope of recovery, for it is an interesting clinical fact that these two different forms of the disease are rarely met with in the same subject. They may for clearness be separately called *internal* and *external* pyæmia, *acute* or *chronic*; pyæmia, when involving internal parts, being generally rapid in its course and fatal; and when attacking external parts, it is as a rule chronic; at times, however, the latter may supervene upon the former variety.

Internal and external pyæmia.

In many cases of pyæmia a peculiar sweet hay-like odour of the breath is undoubtedly present. Some authors, and Braidwood is amongst them, look upon this symptom as pathognomonic.

Traumatic fever.

Traumatic fever, when it occurs, generally makes its appearance from the second to the ninth day after an accident or operation, and seldom lasts over a week. In a simple case it may subside after twenty-four hours, and in a severe one it may continue for a week. When a *relapse*, Rise of temperature.

or a second sudden rise of temperature takes place, grave mischief may be anticipated—some local inflammation, internal or external, being thus indicated. Billroth has described this second attack of fever as "secondary fever." When it runs on for a more lengthened period than a week severe complications are sure to exist to keep up the symptoms. During its course the temperature of the body, naturally 99° F., may rise suddenly 5° or 6° F., and in ordinary cases its fall is as a rule gradual: with its fall defervescence takes place. Should the fall be sudden, a general breakdown of the powers of the patient is indicated, and under these circumstances sloughing of the wound may be looked for. The rise of temperature is generally accompanied by an arrest of secretion or some change of action in the wound, and the fall of temperature indicates the on-coming of suppuration.

Traumatic fever not constant.

It is, however, important to know that traumatic fever is by no means a necessary consequence of an injury or operation, however severe; that it may follow a trivial injury or fail to follow a severe one; and that it is quite impossible to predict its occurrence under any circumstances. After a large number of capital operations it is entirely absent, I should say after one third, and since the practice of the torsion of arteries has been adopted and wounds have consequently been freed from the presence of such foreign bodies as ligatures, the number of cases in which it is absent has decidedly increased.

Arrest of secretion.

Brain complications.

When blood poisoning attacks a patient the subject of a wound, whether caused by operation or injury, it is generally to be observed that the secretion of the wound becomes sanious, serous, or fœtid; probably it will be arrested, and the surface will become glazed or glassy, or perchance assume a sloughing action. The integument around the wound will often have an erythematous blush, or acquire a peculiar leaden, dusky appearance, which is somewhat typical. Union if progressing will cease or become disunion. When any internal organ is implicated, special symptoms indicative of disturbance of its functions will be present. When the *brain* is involved there will be sleeplessness or delirium of a low muttering kind, some unconsciousness from which the patient can be roused only to relapse—"*relapsing unconsciousness,*" —and in rare cases acute delirium and mania.

Respiratory complications.

When the *respiratory organs* are involved—and it may be stated that they are so by far the most frequently—difficulty of breathing, with a harsh dry cough, and perhaps viscid blood-stained sputum, are the prominent symptoms; occasionally pleuritic pains are present, or symptoms of bronchitis, and great dyspnœa.

Abdominal complications.

Joint complications.

When the *abdominal viscera* are affected, nausea or sickness is a prominent symptom, and there is often profuse diarrhœa, this in some cases apparently carrying off the poison. When anything like sallowness of the skin or jaundice appears, hepatic abscess should be suspected; and, under these circumstances, there will often be pain in the region of the liver. At the same time the reader must remember that a slight degree of jaundice is often present without hepatic suppuration. The urine is rarely altered either in character or in quantity, although at times it is scanty and dark coloured. When severe or dull pains are experienced in a joint, suppuration in it should be suspected; for when pyæmia attacks any part, deposits of pus generally result, and anything like so-called rheumatic pains occurring in a patient under these circumstances becomes a source of suspicion; "rheumatic" pains in blood poisoning too often meaning joint or bone mischief of a suppurative kind. It is remarkable, however, how slight the symptoms often are in these cases when severe local disease exists. This fact demands that the Surgeon should ever be on the watch to detect anything like local changes; for it is a pathological fact that there is no organ or tissue of the body in which suppurative disease may not take place in a case of blood poisoning or pyæmia; and it is certainly true that the existence of severe local disease is too often only first discovered on the *post-mortem* table.

Pathological conditions.

What then, it may be asked, are the *pathological conditions found after death* in a case of blood poisoning or pyæmia—using this word in a general sense?

The analysis (shown in the form of a table, page 58) of 203 fatal cases, which I have collected from the records of Guy's Hospital with the sanction of my colleagues Drs. Wilks and Moxon, by whom all the examinations were made, will give an answer to this question.

Pathological Conditions found after Death from Pyæmia.

a. Lungs.

The lungs.—The most prominent fact indicated by this table has reference to the lungs, for it proves that in the larger proportion of fatal cases of blood poisoning these organs are implicated, and that in many they are the only parts involved. Lung mischief was found one hundred and eighty-seven times in two hundred and three cases; and in seventy-eight cases, or thirty-eight in every hundred, the lungs were the only organs affected. *Lobular pneumonia* is the form in which the disease is generally found; and when even a lobar pneumonia is present, it can usually be made out to have originated in lobules, and to have spread from them as centres. This lobular pneumonia, like the lobar form, is also generally seen in the *lower lobes,* and not at the apices, and nearer the surface than the deeper parts. The earliest indication of disease is a lobular pneumonia, and "subsequently," says Wilks, "these congested spots are found to contain inflammatory products, and thus we have red hepatization, suppuration or sloughing." All these stages may often be seen in individual masses. With this lobular congestion of pneumonia some *ecchymosis* of the surface of the lung will generally be found—a purpuric condition in fact—strongly suggestive of blood poisoning. Pleurisy, moreover, generally exists, the fact being accounted for by the superficial position of the lobular pneumonia.

b. Liver.

The liver, like the lungs, is attacked in its lobules. These may be found only congested, or in any intermediate condition between this the first stage of inflammation, and the last, that of suppuration or sloughing. At times this organ is filled with small abscesses. When these abscesses approach the surface of the liver, they may burst and give rise to a general peritonitis. The liver is involved in this affection twenty-seven times in every hundred cases, and almost always in association with disease in the lungs. Thus, out of fifty-five cases in which the liver was affected, in only two were the lungs uninvolved. It would appear, likewise, from the table that the liver is more frequently the seat of pyæmic suppuration after injuries to the head than after any other affection, and that it is rarely found involved after diseases of the urinary organs and burns.

c. Kidneys.

The kidneys.—When the kidneys are affected, it is in the same way as the lungs and liver, small isolated points of suppuration being found, surrounded by a zone of congestion either on their surface or in their cortical structure. They are not affected so frequently as are the two former organs—not more so, indeed, than in seventeen cases out of one hundred. They are more frequently found involved after disease of the urinary organs than any other, and after suppurative disease of the cellular tissue, particularly that surrounding the shafts of bones.

d. Other organs.

In the *spleen* large abscesses are often present. Suppuration may likewise be found in the *brain, heart, prostate, testis, tongue, thyroid gland,* and, in fact, in any portion of the body. In the cellular tissue of the body and extremities a diffused suppuration is very common, and it is also common in the joints.

e. Serous membranes.

Joints.

When inflammation attacks serous membranes, such as the pleura and peritoneum, there seems good reason to believe that it does so from the extension of disease from the lung, liver, or spleen; but in the joints no such connection can be made out. The sterno-clavicular articulation is more frequently involved than any other, for I find that out of the twenty-five instances in which joint complication existed, this was involved in eight; but any joint may be affected. In some cases the articulation is only filled with an increase of synovia, in others the contents are purulent—sometimes pure pus. At times the pus in the joint appears to be so slightly irritating that the cartilage and the synovial membrane are uninjured by its presence, whilst at others it is so destructive as to produce complete disorganization, the bones forming the joint being under these circumstances exposed, and at times necrotic. When these changes occur they are, probably, sometimes due to acute articular ostitis.

f. Skin.

The skin has sometimes a *vesicular* or *pustular eruption* upon it, and too commonly *purpuric spots* or patches are present, which at times go on to mortification; and in connection with this subject "we may mention another evidence of the blood disease in the rapid decomposition of the bodies and the markings of the veins on the surface. Thus, before the body is scarcely cold, there may be sometimes seen the blue and red coursing of the veins and the colouring which has exuded from them into the tissues." (Wilks.)

Inflammation of veins exceptional.

Lastly, it is to be remarked that it is exceptional to meet with any evidence of *phlebitis,* general or local; and this leads me to consider, although briefly, the now already abandoned and untenable theory that phlebitis, or inflammation of a vein, is the cause of pyæmia.

Phlebitis not pyæmia.

The most telling fact against the theory is the one fact mentioned, that it is only in exceptional cases of pyæmia that any evidence can be found of phlebitis; and the second is almost as strong, for "so far from phlebitis being a cause of pyæmia, it is remarkable how often the former occurs without any contamination of the blood whatever; that is, if we can call that phlebitis where we find a vein and its branches quite closed by coagulum or adherent fibrin" (Wilks); indeed, "it is a question whether, in those cases in which the veins are plugged or inflamed, thrombosis and phlebitis are not the local, and pyæmia the general effect of the same cause" (Savory)—blood infection. In this view I cordially agree.

ANALYSIS OF 203 FATAL CASES OF PYÆMIA.

Nature of accident or disease.	Number of cases.	Lungs.		Liver.		Kidneys.		Spleen.		Brain.		Heart.		Joints.		Cell.-tissue.	
		Cases.	Alone.[1]	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.
Compound fracture	26	23	$11_{42\cdot3}$	9	34·6	3	11·5	1	3·8	—	—	—	—	4	15·3	3	11·5
Amputation after compound fracture........................	38	34	$14_{36\cdot9}$	15	39·4	2	5·2	6	15·7	—	—	—	—	4	10·5	3	7·8
Amputation for disease	29	24	$14_{48\cdot2}$	6	20·6	2	6.9	2	6·9	2	6·9	—	—	2	6·9	4	13·8
Injury to scalp and skull......	11	11	$1_{9\cdot}$	7	63·6	—	—	—	—	5	45·4	—	—	1	9·	2	18·1
Inflammation and suppuration of soft parts	33	30	$9_{27\cdot}$	8	24·2	8	24·2	5	15·1	2	6·	5	15·1	8	24·2	5	15·1
Disease of urinary organs ...	22	22	$11_{50\cdot}$	—	—	10	45·4	—	—	1	4·5	1	4·5	—	—	1	4·5
Disease of bones and joints...	28	27	$9_{32\cdot}$	6	21·4	8	28·5	4	14·2	—	—	4	14·2	6	21·4	2	7·1
Operations on soft parts	5	5	$2_{40\cdot}$	1	20·	1	20·	1	20·	—	—	1	20·	—	—	1	20·
Carbuncle	6	5	$2_{33\cdot}$	3	50·	2	33·3	—	—	1	16·6	2	33·3				
Burns	5	5	5_{100}														
TOTAL	203	186 or 91·6 per cent.	78 or 38·4 per cent.	55[2]	27·	36	17·7	19	9·3	11	5·4	13	6·4	25[3]	12·3	21	10·3

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[1] In which the lungs were alone involved, with per cent.

[2] Alone in two cases only, in all others lungs involved.

[3] Sterno-clavicular in eight.

That blood poisoning may take place through veins is highly probable, although, as we have just shown, not from their inflammation; neither is it probable that the absorption of pus, as pus, is the usual cause; for when pus mixes with blood, coagulation is produced, and thus its circulation is prevented. There seems, however, good reason to believe that the fluid portion of pus or of some decomposing inflammatory product may be taken up by the veins and carried into the system, and thus cause pyæmia; a small or large vein when involved in a suppurating or sloughing tissue, importing into the general circulation the poisonous element that by its presence sets up the disease, more particularly when the vein is connected with an inflamed or divided bone.

Theory of pyæmia.

It may, therefore, be fairly inferred that the *milder forms* of traumatic fever are caused by the circulation of morbid elements taken into the blood either from within or without the body, and carried off, sometimes by the lungs, at other times by the intestines; and that the *more severe forms*, as pyæmia, are caused by embolism, the secondary or metastatic abscesses which are found in the tissues being due to the presence of some blood poison, some "pus-germ," which has been arrested in its course, and become the centre of the morbid changes that are seen in the different tissues after death; arrest of the circulation being caused either by embolism of the capillaries of the part from the impaction of some circulating solid particles, or from the coagulation of the blood, or extravasation caused by its admixture with some morbid fluid. This view receives also much support from the fact, that disintegrating fibrin may be carried through the system by the heart or arteries into the smaller vessels in the parenchymatous organs, and give rise, not only to constitutional symptoms much akin to those present in the pyæmia just described, but to analogous pathological conditions. Thus in the "traumatic or venous pyæmia" lobular suppurative changes take place in the viscera or other parts, and in "arterial pyæmia" lobular fibrinous changes occur. In the former case secondary abscesses are found after death, in the latter secondary fibrinous deposits; although it seems probable that at times these fibrinous deposits may break down and give rise to abscesses.

Embolism.

Arterial pyæmia.

This arterial pyæmia is common after rheumatic endocarditis, and is, doubtless, the cause of the so-called rheumatic pains that follow scarlet fever; for in both of these classes of cases it is well to recognise the fact that embolism of large vessels is not uncommon. I have had to remove a leg on two occasions for gangrene from embolism of the femoral artery after scarlet fever. It is not difficult, therefore, to believe that capillary embolism may frequently exist in the same class of cases. This arterial pyæmia is not necessarily fatal. Mild attacks come and go, says Wilks, "the proof being found eventually in the cicatrices and remnants of deposits met with in the organs of the bodies of those who have died with heart disease." The mild forms manifest themselves by pyrexia, prostration, and pains in the joints.

Thus, when a patient dies rapidly from blood poisoning, the only pathological change found in the tissues may be some lobular congestion of the lung, indicating the first stage of pneumonia; when life has lasted longer, red or grey hepatization may be present; and in a later stage lobular suppuration; these different conditions depending upon the intensity of the disease and its duration. "The first stage of the morbid condition which is produced in the viscera is a coagulation in the vessels, and the last stage is a suppuration." (Wilks.)

In feeble patients who have no resisting power against disease, it is possible that even these pathological conditions may not be found; life being, as it were, suddenly destroyed in the first onset of the blood poisoning. Under these circumstances no definite post-mortem appearances would be seen beyond, perhaps, a general softness of the viscera, or some purpuric condition.

Duration.

Duration of the disease.—There seems reason to believe that a patient may die in two or three days after the first appearance of the symptoms; as a rule, bad cases terminate during the second week. Some go on for six or seven weeks. The longer a patient lives the better are the hopes of a successful issue.

Prognosis.

Prognosis.—In every case of blood poisoning great cause for anxiety exists, it being impossible to foretell its course or its end; for in one case, a small dose of the poison will prove fatal, while in another a full dose will be thrown off. The violence of the attack does not apparently depend upon the severity or size of the wound; for a trifling wound is at times followed by urgent symptoms, while a severe local injury may be followed by few complications. Indeed, it does not depend upon a wound at all, for the severest cases of blood poisoning are found in those in whom there is no wound; a slight injury under certain circumstances, or no injury at all, being followed by the severest symptoms.

A robust subject, doubtless, has a better chance of recovery than a feeble one, and an abstemious one than a drunkard. Where diseased viscera exist, particularly diseased kidneys, the prospects of recovery are poor indeed, the capabilities of a patient to resist any diseased action under these circumstances being slight in the extreme. A single attack of traumatic fever may pass off without trouble, but a relapse or second attack always indicates mischief. Rigors rarely occur without suggesting the presence of some secondary deposit or local inflammation. One rigor may pass off and leave no trace of harm behind, but a succession of them is associated too frequently with the gravest local complications, such as secondary metastatic abscesses. These abscesses also when they occur outside any of the three great cavities, are less dangerous than when they occur inside. Acute disease is always accompanied with great danger; when it is chronic there is always more hope.

Comparative frequency after injuries and diseases.

The occurrence of pyæmia in different classes of cases is well shown in the following tables:

Analysis of the 217 *cases of Pyæmia.*

Of 217 cases—
68 or 31·3 per cent. were after compound fractures as a whole.
24 or 11· per cent. not amputated.
44 „ 20·2 „ amputated.
26 „ 12· „ were after amputation for disease.
28 „ 12·9 „ „ after other operations.
21 „ 9·6 „ „ after injury without operation.
60 „ 27·6 „ „ after disease without operation.
12 „ 5·5 „ „ idiopathic. 2·9 per cent. puerperal.

Through the kindness of Dr. Steele, who has aided me in this statistical investigation, I am able also to give the following interesting facts respecting pyæmia :

Out of 790 cases of compound fracture, 192 died, or 24· per cent.
68 of pyæmia, or 8·6 per cent.
Of 184 treated by amputation—
89 died, or 47·7 per cent.
44 of pyæmia, or 23·9 per cent.
Of 606 treated without amputation—
103 died, or 17· per cent.
24 of pyæmia, or 3·9 per cent.
„ 324 cases of amputation of thigh, leg, arm, and forearm for disease . . . 126 died, or 38·8 per cent.
26 of pyæmia, or 8· per cent.

Pyæmia is thus seen to be three times as fatal after amputation for compound fracture as for disease.

Out of 29,434 surgical cases admitted into Guy's during 10 years, there were 1749 deaths, or 5·9 per cent.
203 of these were from pyæmia, or 11·6 per cent. of the fatal cases; about one in nine of the deaths being from this cause.
But of the whole number of cases treated, pyæmia was fatal in one case out of about 150.

Pyæmia not a hospital disease.

But is pyæmia a hospital disease? Does it arise from causes that are generated in a hospital? or is it met with more frequently in a hospital because the class of cases in which it is most prone to occur are there collected? Is it found in private practice?

As an answer to the last question it is only necessary for me to refer to Mr. Prescott Hewett's presidential address at the Clinical Society in 1874, in which he gave the particulars of twenty-three examples of pyæmia occurring in private practice, and in six only after operations, four being very trivial.

Sixteen of these were in town and seven in the country, and all were placed under most favourable circumstances.

We know also that some of the worst cases of pyæmia that are seen in the London hospitals—and I can answer for Guy's—are admitted with the affection.

Under these circumstances it may with confidence be asserted, that what is known as pyæmia is not a hospital disease, and that it probably occurs after surgical injuries and operations as frequently in private as in hospital practice. It is true that pyæmia often takes its origin in hospitals, but it seems equally true that it does so because the cases in which the affection is prone to occur are there concentrated.

Blood poisoning may occur anywhere, in hospitals or in private houses; its causes are not yet obvious—they want elucidation—but for lack of such it is unfair and unscientific to assign them without reason or even argument to what has been so wrongly described as "Hospitalism."

Treatment.

TREATMENT.—An unlimited supply of fresh air, simple nutritious food, and, where a wound or suppuration exists, the most thorough cleanliness, are the main points of practice to be observed in the treatment of every case of traumatic fever or pyæmia. Compared with these all others are of secondary importance.

The disease being due to a blood poison, often taken into the body from without, it is the Surgeon's duty to see that the patient's room is well ventilated, that it is neither too hot nor too cold, as both extremes are powerful depressants; that the air circulating through it is free, fresh, and fragrant; that the room is frequently purified by cleansing and disinfectants, large dishes of any disinfecting fluid being distributed about, and cloths saturated with the same; solid iodine exposed in a plate to the air is a good disinfectant, and more persistent than some others. Care must be taken that no drain poison or closet effluvium can possibly reach the room; and that all excretions are disinfected at once, indeed, passed directly into vessels containing disinfecting fluid, such as Condy's, or carbolic acid, chloride of lime, or chloralum. The wound should be kept clean, and care observed that all discharges are allowed free vent. Dressings, when employed to a suppurating or sloughing wound, should be saturated with disinfecting lotions, and changed every three or four hours. When possible, foul wounds should be irrigated, a stream of warm water containing a disinfectant being allowed to run over the surface. I know of no means so valuable for keeping a wound clean as this. When sloughing of the part exists, charcoal poultices are at times of use. Sponges should never be employed where pus exists, but rather tow or cotton-wool, more particularly the absorbing cotton-wool known as Brun's, which can be thrown away; or camel's hair pencils as suggested by Callender, kept in a lotion of carbolic acid. Poultices, when employed, may be put on tow or oakum, both these materials, through the tar they contain, being disinfectants.

a. In simple cases.

In simple, *uncomplicated traumatic fever,* when it stops within the ordinary bounds, and neither runs on nor returns in its severity, no special treatment is called for. Should restlessness or much pain exist, a sedative dose of chloral, opium or morphia, may be given, either by the mouth, rectum, or skin, and beyond this nothing is needed.

b. In systemic infection.

In more confirmed cases of suppurative fever, when systemic infection is declared, the vital energies of the patient must be maintained or stimulated, and everything that tends to lower them must be warded off; thus the administration of tonic medicine becomes a necessity, the preparations of iron being the best, but strychnine and quinine are likewise of great use. Some Surgeons employ very large doses of quinine, and speak highly of it,—from ten to twenty grains being given at the first onset of pyæmia, and repeated every three or four hours,—and Dr. Goodhart's investigations ('Guy's Hosp. Rep.,' 1870) seem to show that quinine in full doses helps defervescence. Stimulants must be given with caution, and their amount regulated by the wants of the individual case. When the patient's habits have been free, alcohol in some of its forms will be required, even in large quantities; but to an abstemious person a very moderate dose will be enough, a large one doing harm; and that form of stimulant is apparently the best to which the patient has been accustomed.

Diet.

The diet should be as nutritious as possible, but its nature must depend upon the assimilative powers of the stomach. Where milk agrees, no better drink can be given, either alone or mixed with eggs or some spirit; cream may be added at times, or the concentrated Swiss milk; animal broths may likewise be freely used. When meat can be digested it may be given, although sparingly. When a patient refuses food, Liebig's extract of meat, or Darby's fluid meat, may be mixed with his beer or wine without his knowledge; and when the stomach rejects nourishment it must be given by the rectum, an enema of beef tea and egg being administered every four or six hours. Ice may always be allowed in small quantities, as it gives comfort. When the nervous system is disturbed from want of sleep or otherwise, opium may be given, small doses frequently repeated being better than large. Where enemata are used, laudanum may be mixed with them.

Opiates.

Laxatives.

Should diarrhœa exist it must not be checked too suddenly, for in some cases of blood poisoning it appears to have an eliminative tendency; it should be stopped only when telling on the patient's powers. To give remedies, however, with the view of eliminating the poison by the bowel is a rash practice, and cannot be recommended. The sulphites and chlorides in any of their forms do not appear to have any power to neutralise the poison in the blood; they have been, however, highly praised. The alkaline salts have likewise been strongly recommended "to promote the changing and eliminating of the products of the retrograde metamorphosis of the tissues" (Savory). Of these the carbonate of ammonia is probably the best, either given alone or with the liquid extract of bark.

Opening of pus depôts.

When secondary abscesses have formed in the cellular tissue and between the muscles they should be opened; but great caution should be observed in dealing with inflamed joints. When the presence of pus can be clearly made out it should be evacuated by a free incision into the joint, and care taken that it does not re-accumulate; indeed, the joint should be freely washed out with a stream of warm water coloured with Condy's, or some other disinfecting fluid, such as carbolic acid, one part in forty. Soothing applications should at the same time be employed, poppy fomentations being probably the best.

When acute blood poisoning has set in, it is almost needless to say that amputation of a diseased limb has no influence in checking the disease; nor has the application of caustics or cauteries to a wound; indeed, no local treatment is known by which the formation of secondary abscesses can be prevented. In chronic pyæmia, however, amputation is often of essential service.

How far blood poisoning can be prevented is another question, and as it is an important one it may be considered here.

Exciting causes.

Concerning the exciting cause of the disease nothing is known; it attacks the healthy as well as the cachectic; those surrounded by perfect hygienic influences, as well as those who are subjected to the most imperfect. It is not a hospital disease solely; for it is found in private as well as in public practice, and some of the worst examples of the disease are often brought into a hospital, and not generated in it. It is true that the cachectic, and those who are subjected to close and unhealthy atmospheres, are the more prone to its attack, and that overcrowding in small wards, bad ventilation, bad drainage, and bad feeding are known to have an injurious tendency, with every other influence that has a depressing action on the vital powers. It becomes the surgeon's duty, therefore, to ward off, as far as he can, all such influences. In cases of operation, when any time is allowed for preparation, the general condition of the patient should be inquired into; the surgeon should see that the excretory glands are performing their functions, and if not he should, if possible, correct them. The feeble must be

Prophylactics.

strengthened by tonics and good nutritious food, and the supply of stimulants should be regulated in all. The intemperate man must be brought to understand moderation, and to know that life cannot long be sustained by drink alone; and must learn that stimulants are chiefly of value in assisting digestion and the assimilation of nutritious food. The urine under all circumstances should be examined for albumen; for although the knowledge of its presence would not deter the surgeon from performing an operation of necessity, to save life, it would affect his prognosis, and would most certainly influence his decision in an operation of expediency. All patients after operation should be kept in absolute repose, the wounds kept clean, and lightly dressed. Everything that tends to procure rapid union must be considered good, and everything that induces or keeps up suppuration bad, blood poisoning and suppuration, whether with or without a wound, having a close connection. No one who has been in contact with any infectious disorder, such as erysipelas or scarlet fever, should be allowed to come about the patient; for there can be no doubt that there is some subtle connection between these poisons and pyæmia. And lastly, every cheering influence should be brought to bear on the mind of the patient, as well as on his surroundings; for amongst the agents predisposing to blood poisoning, mental anxieties and depressing emotions must doubtless be reckoned.

Avoid infectious disorders.

HECTIC FEVER.

There can be little doubt that surgeons of former times included under this title many cases of what we now call septicæmia, pyæmia, or blood poisoning; and even at the present time it is an open point as to how far the symptoms which denote hectic fever are due to the absorption of some foreign element into the blood.

That hectic fever is always found in those who are the victims of destructive organic changes, chiefly of a suppurative nature, is an established fact; and it is in them confirmed blood poisoning is generally found. The physician meets with this condition in pneumonia, phthisis, empyema, abscess in the liver, kidneys, or ovary; the surgeon in suppurative diseases of joints and bones, in spinal disease, compound fractures, diffused suppurations, &c. In all classes of cases there is a destructive wasting and influence at work, undermining the patient's powers and producing general emaciation. The characteristic symptoms are of a remittent nature, and usually appear at least once daily, towards evening, but they may do so more frequently, indeed they are not unlike those of ague.

Symptoms.

Febrile symptoms are always present, and a paroxysm of hectic may be said to commence with them. The fever may be more or less intense; the skin will be hot and dry, and the pulse rapid, but always feeble. The face will be flushed in a single patch, and the palms of the hands and the soles of the feet hot and burning. The tongue during the paroxysm may be dry, and great thirst will be present. There will, however, be no brain symptoms, no clouding of the intellect, no delirium. The febrile condition may be preceded by shivering or chilliness, but such symptoms are far from usual; they are, however, always followed by *a profuse and exhaustive sweat.* This sweating is indeed peculiar to the affection, for it bears no proportion to the febrile symptoms that preceded it. At the commencement of the disease the febrility may be

Fever.

Rigors.

Sweating.

so slight as hardly to be noticed, and yet the patient on falling to sleep and awakening will be bathed in perspiration. When the disease is at its height the cold, hot, and sweating stages may be well seen; but when it declines the febrile symptoms will be constant, although aggravated towards night, the morning "colliquative" sweats gradually becoming more profuse as life ebbs away.

In the early stage of this disease there may be no fever *between* the paroxysms. The tongue, dry during the attack, will be moist and clean, but towards the close, morbidly red, smooth, and sore, with aphthous ulceration. The appetite and assimilative powers are rarely much affected; indeed, they are little altered till the powers are failing rapidly. The skin, at first supple and moist between the attacks, becomes harsh, dry, and covered with branny scales. The urine, always scanty and high coloured, becomes more so towards the close of the disease. The bowels are sometimes constipated, but more frequently loose, or diarrhœa may depress the system. Throughout the disease, however, the mental faculties remain intact. The bodily powers may be reduced to a minimum, but the mental will remain clear, and at times vigorous. During the whole disease sleep is usually obtained between the attacks. Death always takes place from exhaustion, and bed-sores too frequently form and add to the sufferings of the patient.

Treatment.

TREATMENT.—The removal of the cause of the disease is the only means by which its cure can be obtained. Under any other circumstances *relief* alone can be looked for or attempted, as the affection is one purely of exhaustion, the waste of the tissues being greater than their repair. The object of the surgeon must be to maintain the strength of the patient in every way by the administration of abundance of simple nutritious food, with stimulants carefully adjusted to the special wants of the case. Food should be given at certain short intervals in small quantities. Stimulants and food should be given together, the former in sufficient quantities to enable the latter to be digested.

Tonic medicine should always be given, and probably quinine is the best, for this drug has, doubtless, a power in checking febrile action, in keeping down the temperature of the body, and preventing sweats. It should be given in a full dose, five grains in the solid form, before the paroxysm. Iron and strychnine are also valuable drugs.

Diarrhœa, when present, should be checked by astringents, but opium should be sparingly employed, except to relieve pain.

Question of operation.

With respect to the removal of the cause of the disease by operation, when it can be entertained there can be no difference of opinion between surgeons. When hectic exists and is established, it is clear that nature's reparative powers have been found wanting in their efforts to cure the local affection, and it is hardly probable that they will improve with the drain upon their strength still continuing. The surgeon's duty under these circumstances, therefore, doubtless lies in operative interference. If the disease can be removed, this should be done; delay is almost criminal. Let the source of irritation, or weakness, be removed, and it is wonderful how rapidly the most feeble subject may rally after the operation. If the viscera are sound good hopes of a recovery exist under apparently the most adverse conditions; but if the kidneys are diseased, the prospects of recovery are but feeble.

Moxon, 'Guy's Hosp. Reports,' 1871.—*Wilks*, 'Guy's Hosp. Reports' for 1861 and

1870.—*Lee*, "On Phlebitis." 'Practical Pathology.'—*Paget and Savory*, 'St. Bart. Reports,' vols. i and ii, 1865-6.—*Virchow*, 'Cellular Pathology.'—*Pick*, 'St. George's Hosp. Reports,' vol. iii.—*Billroth, Dr. Th.*, Archiv für Klin. Chirurgie' (Langenbeck's), B. ii, vi, viii, ix.—*Bristowe*, 'Trans. Path. Soc. Lond.,' vol. xiii. Reynolds's 'System of Medicine.'—*Roser*, 'Sydenham Soc. Year-Book,' 1863, p. 192.—*Prof. O. Weber*, 'Berl. Klin. Wochenschr.,' 1864. 'Year-Book,' 1864, p. 227.—*Gibson*, 'Brit. and For. Med.-Chir. Rev.,' Jan., 1866.—*Callender*, Holmes's 'Syst. of Surg.,' 2nd edit., vol. i.—*Sedillot*, 'On Pyæmia,' 1849.—*Arnott*, 'Med.-Chir. Trans.,' vol. xv.—*Braidwood*, 'On Pyæmia,' 1865.—*Griesinger*, "On Leukæmia and Pyæmia," Discussion at Clin. Soc., 1874.

CHAPTER II.

ON ANIMAL POISONS.

POISONED WOUNDS.

On poisoned wounds.

UNDER this heading, Dissection Wounds; wounds from the sting or bite of healthy insects and animals, and wounds from the bite of diseased animals, or inoculation from their blood, will be considered.

Dissection wounds.—These are of frequent occurrence, although it is exceptional to find them followed by any ill effects; they, in common with all wounds, may be attended with absorbent inflammation, inflammation of the cellular tissue, suppuration, septicæmia, or pyæmia; and feeble or cachectic subjects are more prone to any one of these consequences than the strong and steady.

In exceptional instances, however, different results follow, and two forms of the affection may be recognised—the *mild* and the *acute*.

Symptoms of mild form.

"The symptoms in the *mild* form partake," says Poland, "more or less of the ordinary character of non-specific inflammation, and scarcely present any noticeable characteristic signs; thus, the local appearances consist in the puncture assuming a defined red aspect, which soon becomes pustular; this bursts, and ends in an unhealthy suppuration; there is surrounding erythema of an erratic form, and inflammation and pain extending along the forearm and arm to the axilla, ending in the enlargement and suppuration of the glands. The constitutional effects consist in febrile disturbance, loss of appetite, diarrhœa, fetid eructations, &c. The prognosis and termination are favourable; and the treatment required is to be based upon general principles.

Symptoms of severe or acute form.

The symptoms of the *acute* or severe forms are those of a truly specific disease; the local signs commence by the appearance of a small circular or oval vesicle over the seat of puncture, which soon becomes turbid, milky, and pustular, and not unfrequently has a defined margin, resembling somewhat that of smallpox. This is generally unattended with pain; but the patient often complains of intense pain in the shoulder and about the axilla, which shoots down the chest. The glands in the axilla are early affected, and seem to act as barriers to the further progress of the poison; they become enlarged, and the surrounding cellular tissue is implicated, with serous effusion; there is erythema and puffy swelling; these extend to the subscapular and pectoral regions, spreading down the side of the chest, yielding to pressure, and imparting a peculiar spongy feel. There is, besides, an œdematous and doughy condition of the arm and forearm, owing to serous exudation into the cellular tissue, which seldom, if ever, passes into suppuration."

"The constitutional symptoms are at first those of strong excitement; but these are soon followed by those of extreme depression of spirits and much suffering. Rigors, headache, prostration of strength, vomiting, &c., supervene; and, lastly, all the symptoms of low typhoid fever rapidly set in."

Constitutional symptoms.

In some cases the absorbent glands are not involved, and death may occur from prostration in the early stage of the disease; in others, suppuration and pyæmia may appear, whilst in a third class extensive and diffused sloughing of the skin may ensue; all these points being materially influenced by the power of the patient to throw off morbific influences.

Prognosis of acute form.

The *prognosis* in these acute cases must be unfavorable. Travers gives it that one in seven recovers; probably this is rather in excess of what is true; but if the patient does not sink during the violence of the attack, his powers will be tried to the utmost by the protracted suppuration.

The inoculation from a recently dead body is far worse than from an old dissecting-room subject, and the fluids from a patient who has died from glanders, peritonitis, and scarlet or puerperal fever, are far more dangerous than any other. Indeed, there is reason to believe that the contact with such fluids is capable of giving rise to the disease without any local wound or abrasion.

The poison probably acts upon the blood and nervous system.

Treatment of poisoned wounds.

TREATMENT.—To keep the patient alive during the treatment of the disease and treat local symptoms, as they arise, on general principles, is the usual method now pursued.

Every student when he pricks his finger should at once clean and suck the wound, arresting the circulation through it, by pressure with the opposite hand on its cardiac side; he should do this for at least a minute. The part may then be closed over, a piece of gutta-percha skin made adherent with chloroform being an admirable application. When the wound is free and the poison is from a recent puerperal or allied case, some caustic, such as the nitrate of silver, chloride of zinc, or even nitric acid may be applied. The two first are probably the best. Should any inflammation appear, a poultice should be applied, and the hand be raised above the shoulder, and if there should be any tension of the part it should be at once relieved by an incision.

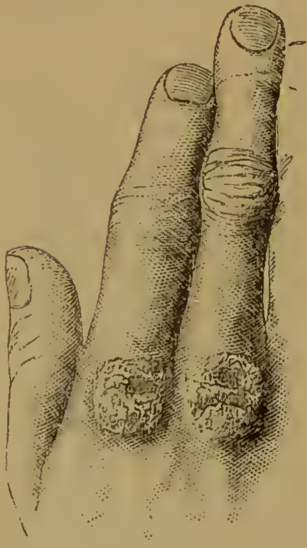
Spreading, absorbent, or cellular inflammation should be treated by fomentations; some surgeons have faith in the local application of nitrate of silver, iodine, or the solution of the perchloride of iron to arrest its progress. The glands when enlarged should be freely bathed with hot water, and hot fomentations kept on constantly. The earliest indications of suppuration should be looked for in order that pus may be at once evacuated. Sloughs are to be let out by moderate incisions. Tonics should be given from the first, iron when it can be borne, with or without quinine in full doses, or ammonia and bark when these tonics are inapplicable. Nutritious food is to be given in abundance, milk being the best drink; stimulants when needed, but always with caution. Country air, as soon as it can be enjoyed, is the great aid upon which reliance can be placed for recovery.

Anatomical tubercle.

Anatomical tubercle.

This is a chronic skin affection, which is to be met with on the hands of those constantly engaged in making post-mortem examinations. Dr. Wilks, when describing some models of the affection that are to be seen in Guy's museum (Fig. 4), has called it "*verruca necrogenica*" ('Guy's Rep.,' 1862). In its early stage it is not unlike epithelial cancer; "it commences without any evident breach of surface, the parts affected being not those liable to pustules, as the back of the hand or wrist, but the knuckles and joints of the fingers. If the disease should begin with a pustule, the latter bursts, but instead of healing, a thickening of the cuticle takes place around it, and as from time to time a little fresh suppuration occurs, so the thickening and induration increase. Generally, however, these changes go on slowly, without any preliminary vesication. A warty thickening of the epithelium takes place, which, in course of time, becomes of a dark colour, until a kind of icthyotic condition is produced."

Fig. 4.



Anatomical tubercle.
Model Guy's Mus. 193^{50}.

The disease is a local one, and is unattended by constitutional symptoms. The repeated application of the strong tincture of iodine, acid nitrate of mercury, or nitric acid, will effect a cure.

Insect stings.

Insect stings in this country are not very severe, and, unless inflicted in large numbers, are rarely brought under the notice of the surgeon. Some little fever and constitutional disturbance may follow in children who are susceptible to external influences, and in others, local swelling, heat, and redness are very marked. Should a wasp or bee accidentally be taken into the mouth with fruit, and the base of the tongue, pharynx or larynx, stung, serious symptoms may appear from the œdema and swelling of the parts impeding respiration. When this accident happens, scarifications should be employed with fomentations, but if life be threatened the air-passages must be opened.

When the tongue is the part affected, the sting should be removed, if possible, with a pair of fine forceps, and in other cases, where this can be done, much pain is saved. The best application is the liquor ammoniæ or sal volatile; a drop of either of these applied to the part after any insect-sting generally giving relief. The parts should also be protected from the air by collodion, flour, chalk, or strapping.

In the tropics, the bite of the scorpion, the tarantula, and other insects, is, however, more troublesome, the accident being often followed by nervous depression, vomiting and local pain. In South America, the mosquito bite is often followed by severe local inflammation and sometimes by ulceration. In Africa and Asia, the scorpion, which is often from six to ten inches long, is so venomous as to cause, at times, by its bite, loss of life. Olive oil is the usual application for the wound, but the liquor ammoniæ is probably better. Brandy and ammonia should be given internally when great depression exists.

The bite of the spider is in its effects very similar to that of the scorpion; the wonderful stories about its poisonous qualities are now believed to be fabulous.

Serpent bites.

Serpent bites are often serious, and at times fatal, the venomous poison being squeezed into the tissue in the act of biting from a special apparatus situated at the base of the upper fangs. In England, the *viper* is the only poisonous reptile, and although some local and constitutional disturbance may follow its bite, a fatal termination is rare.

The *cobra di capello, rattlesnake, whipcord snake,* and *phoorsa snake* are the most venomous.

In some cases the poison seems to spend its effects upon the nervous system, killing by convulsions or coma; in others, its local effects are the more important.

Mitchell's account of rattlesnake bites.

Dr. S. Weir Mitchell, of Philadelphia, who has carefully studied the effects of poison by the rattlesnake, tells us that the bite is variably followed by bleeding, but soon by swelling and discoloration of the injured part and tissues around, these symptoms depending upon the effusion of blood into the cellular tissue. Pain of a pricking or burning character also follows, gradually becoming more intense. The wounded extremity becomes larger and the pain greater, the skin assuming a mottled marbly aspect. As a secondary effect, inflammation of the tissues follows and disorganisation, the inflammation assuming more the character of the phlegmonous erysipelas, associated with glandular enlargement and suppuration, gangrene being a common consequence.

With these local changes the constitutional are in accord, great depression of the nervous system and general prostration being the most prominent symptoms, with profuse cold sweats, vomiting, dyspnœa, and diarrhœa; jaundice often preceding death.

Prognosis.

When the dose of the poison is great, or the susceptibilities of the patient are acute, the general prostration of power and local stagnation of blood in the wounded extremity sometimes kill at once; and in the case of a keeper of the London Zoological Gardens, who was bitten in the nose by a cobra, half an hour only had elapsed when he was apparently dying, being unable to speak, swallow, or support himself; the pupils were dilated, the face was livid, heart's action feeble, and he was scarcely conscious; death taking place in little more than an hour from the infliction of the wound.

Mitchell has recorded a fatal case in five and a half hours. Of others one died comatose, another with dyspnœa and dysphagia, a third felt sleepy and died without agony.

On the other hand, patients at times recover suddenly, even when the symptoms have been severe, as if the poison suddenly lost its influence. More commonly, however, death ensues, and when recovery follows, it is only after severe local suppuration and sloughing, leaving a maimed and useless limb.

Appearances after death.

After death, Mitchell found ecchymoses in the thoracic and abdominal viscera, the spots containing blood-cells, this exudation being purpuric in its nature, and clearly caused by a want of the normal coagulating power in the blood; indeed, this altered condition of the blood is the most common effect of snake poisons, and in some cases it is said to last through life; thus, in bites from the Indian phoorsa snake, there is said to be a hæmorrhagic tendency during life. After death Mitchell could never detect the least alteration in the blood-cells in acute cases, and in exceptional examples of chronic poisoning he found a few globules indented. In chronic cases, also, where time for the poison to act upon the blood has been allowed, the want of coagulating power in the blood is very constant, putrefactive changes rapidly following.

Dr. Halford, of Melbourne, says, he always found the blood after death dark and fluid. He found it also to contain germinal nucleated cells, which he regards as molecules of living foreign matter thrown into the blood from the venom, which increase and multiply at the expense of the oxygen normally wanted in inspiration, and hence, it seems, arise asphyxia and death.

Dr. Fayrer, late of Calcutta, tells us, however, that he has never been able to detect these changes in the blood, although the blood is affected by the poison, and through it the nervous centres. ('Indian Annals of Med. Science,' 1870.)

Treatment of serpent poisoning.

TREATMENT must be most energetic, otherwise the depressing influence of the poison will soon paralyse all action, a few seconds being enough for the absorption of the poison.

Local.

Locally, the aim should be to arrest the absorption of the poison into the circulation by fastening a ligature firmly on the cardiac side of the wound, by excising the wounded part, and the application of nitric acid, carbolic acid, or the nitrate of silver.

Fayrer records, that the natives of India apply a ligature not only just above the bite, but at several places on the limb at intervals of some inches. The danger and difficulty lie in not applying the ligature quickly enough. The ligature must also be tightened to the utmost, till the circulation is entirely arrested and the part is livid with retained blood. The punctures should then be scarified to allow the blood to flow freely, and then the cautery or caustics should be applied. The Indian natives place a live coal upon the wounded part.

Constitutional.

Constitutionally, the best treatment lies in the administration of ammonia and stimulants, to maintain the action of the nervous and circulatory systems, and thus keep the patient alive whilst the poison is being worked off or becomes exhausted; for the man who is dying from snake bite is perishing from rapid exhaustion of nerve force. Any other measure that can rouse and stimulate the failing nervous energy may also be employed.

Fowler's solution in full doses every half hour for four hours has been said to have been useful. Iodine has also been advocated, and olive oil in full doses internally highly praised. In countries where poisonous snakes abound, different roots have their reputation, such as the guaco, the sacræ vitæ ancora, radix corineæ, decoction of Virginia snake-root, &c., &c.; but Fayrer, after repeated experiments, believes them to be utterly useless.

Injections into veins.

Halford has thought, by his experiments, that the injection of twenty to thirty drops of a solution of one part of the strong liquor ammoniæ to three parts by measure of water into one of the veins of the wounded limb, accompanied by the local application of the liquor ammoniæ to the part, is a specific; but Fayrer, who has tried the practice, has failed to find the success he looked for. Mitchell advises ligature to the cardiac side of the wound, excision, amputation, or destruction by cautery or escharotics of the poisoned part; and even *suction* of the part directly on its receipt, the poison having no influence in the stomach. He thinks well also of the injection into the wound of iodine or ammonia, and says the natives believe the local application of olive oil to be the best. With this local treatment, the patient's mind is to be kept up by hope, and his heart going by stimulants, quite irrespective of quantity, the general powers being maintained by nutritious food. By these means, "if the person be not thoroughly poisoned, we may help him to recover. If he be badly bitten by one of the more deadly snakes, we can do no more." (Fayrer.)

Bites of diseased animals.

Hydrophobia.

Hydrophobia, meaning the "dread of water," or more correctly "RABIES," is a disease contracted from a rabid animal, and generally from its bite through its saliva or mucus; it is always fatal.

It is more common in temperate regions of the world than in the torrid and frigid zones. It is unknown in Australia, New Zealand, Greenland, and Kamschatka. It appears at all seasons.

Blaine and Youatt affirm that in animals rabies is entirely due to a traumatic action—viz., the bite of some rabid creature inflicted on another previously free from the disease. But Fleming, the most recent authority, tells us that the virus of rabies may under certain favourable conditions be generated directly without the intervention of any infecting medium, although at present we are in complete ignorance of the conditions on which its spontaneous production depends. All animals bitten do not contract the disease, as proved by Renault, of Alfort, who caused dogs, horses, &c., to be bitten several times and even inoculated them, and out of 99 cases, 67 contracted the malady, and 32, or one third, escaped. Fleming calculates that 30 or 40 per cent. of people who are bitten by mad animals go mad.

Symptoms in the dog.

In the *dog* there are three well-marked stages of the complaint. The *first* is the *melancholic*, characterised by melancholy, depression, sullenness, and fidgettiness; the *second*, the *furious*, by excitement, by rabid fury; and the *last*, the *paralytic*, by general muscular debility and actual *paralysis*.

Stage of depression.

"The dog," writes Trousseau, "looks ill and sullen after a period of incubation of very variable length; he is constantly agitated, turning round and round inside his kennel, or roaming about if he is at large. His eyes, when turned on his master, have a strange look in them, expressive of sadness as well as of distrust. His attitude is suspicious, and indicates that he is not well; by his wandering 'he seems to be seeking' for a remedy. He is not to be trusted; if he obeys at all, he does it slowly; if you chastise him he may, in spite of himself, inflict a fatal bite. "His agitation increases; if in a room, he runs about looking under the furniture, tearing the curtains and carpets, sometimes flying at the walls, at others jumping as if to catch flies; the next moment he stops, stretches his neck, and seems to listen to a distant noise. He probably has then hallucinations of sight and hearing."

Stage of excitement.

"This delirium," says Youatt, "may still be dispersed by the magical influence of his master's voice; all these dreadful objects may vanish, and the creature creeps to his master with the expression of attachment peculiar to him."

Stage of muscular debility.

"There follows then an interval of calm; he slowly closes his eyes, hangs down his head, his fore legs seem to give way beneath him, and

Still laps fluid.

he looks on the point of dropping. Suddenly, however, he gets up again; fresh phantoms rise before him; he looks around him with a savage expression, and rushes against an enemy which only exists in his imagination. By this time the animal's bark is hoarse and muffled; loud at first, it gradually fails in force and intensity, and becomes weaker and weaker. In some cases the power of barking is completely lost; the dog is dumb, and his tongue hangs out through his half-opened jaws, from which dribbles a frothy saliva. Sometimes his mouth is perfectly dry, and he cannot swallow, although in the majority of cases he can still eat and drink. When he cannot drink, he will lap fluids with great rapidity, but on looking closely it will be seen that he merely bites the water. He can still, in some cases, swallow solids, and he may then swallow anything that is within his reach, bits of wood, pieces of earth, straw, &c."

"Towards the close of the second stage of rabid fury the dog often breaks his chain and runs away; he wanders about the fields, being seized from time to time with paroxysms of fury, and then he stops, from fatigue, as it were, and remains hours in a somnolent state. He generally dies in a ditch or retired corner, apparently from hunger, thirst, and fatigue."

Veterinary surgeons do not say that he dies from asphyxia, brought on by spasm of the pectoral muscles or by convulsions. The disease runs its course in from five to eight days. It is the same in the dog, cat, horse, and wolf, and from any of these, man may become inoculated.

Symptoms in man.

Period of incubation.

In man the disease may show itself at any period from six weeks to a year after the inoculation, although Fleming and Bouley assert that the incubatory period in man varies from one to two months, and that after the third month the chances of immunity are great. Thamhayn ('Schmidt's Jahrbuch.,' 1859), in an analysis of 220 cases, showed that in 49 the symptoms appeared within a month, in 98 during the second, in 29 during the third, and in 26 during the fourth month; 16 of the remaining cases showing themselves within twenty-six months, two cases only maturing at a period of four and five and a half years respectively. But these cases are always doubtful; they are probably examples of hysterical or *nervous hydrophobia*. Fleming, however, records some striking cases which seem to show that the latent disease may be induced or brought into activity by mental agitation ('Rabies and Hydrophobia,' 1872).

The disease may attack the infant at the breast or the aged, the male or the female, and during the incubative stage there is no disturbance of the general health to be observed. Van Swieten has pointed out that during this period such a disease as variola may run its course without any modification, two poisons thus co-existing in the same frame.

Premonitory symptoms.

After the incubative stage has passed, the *first symptom* usually displayed is one of sadness; the victim either does not suspect his complaint, or carefully avoids mentioning the circumstance. His sleep will be disturbed; he is fidgetty, sighs deeply, and avoids society; noise seems to trouble him; many are very irritable and ill-tempered. The *second stage* will be marked by an aggravation of all these symptoms, but in addition pain in the region of the heart will be present, and some irregularity of the pulse. Rigors will soon appear, which, says Trousseau, "are true convulsions of all the muscles of the body;" and lastly, the characteristic symptom of dread of water, not as fluid, however, but as connected with the difficulty of drinking. The sight of water is frequently sufficient to bring on shuddering, but it is when the patient carries water to his lips that he is seized with the typical terrors. A rabid man is always rational; he tries to drink, but the attempt excites terror and the expression of his inability. His eyes become fixed, features contracted, and his countenance expressive of the deepest anxiety, his limbs shake and whole body shivers. The paroxysm lasts a few seconds, and then subsides into quiet, but only to be recalled on the slightest breath of air touching his body, for *hyperæsthesia* is one of the most marked symptoms of the affection.

Characteristic symptoms

During the calm, nausea or even vomiting may appear, and priapism is often a most distressing symptom. Sudden terror of an unknown kind haunts the mind, imaginary callings of fiends often existing. Dr. Bergerons records a case in which the patient heard the ringing of bells, and saw mice run about in his bed.

In the third and last stage the longing for drink becomes intense, but the inability to take it greater; the voice becomes hoarse and the mouth full of a frothy fluid. The patient tries to get rid of this by spitting, and then becomes frightened at its results; in some cases he fears that by contact this fluid may propagate the disease. Convulsive seizures increase in frequency and intensity, the spasm of the respiratory muscles threatening life; at last a fatal spasm takes place, and death by asphyxia ensues.

Final symptoms.

In the dog death is from paralysis, in man generally from asphyxia; in exceptional cases it is from exhaustion.

Cause of death.

This painful affection rarely lasts longer than four days; it has been fatal in sixteen hours, and has lasted as long as two or three weeks. Thamhayn shows by his figures that 56 out of 202 cases died within forty-two hours, 73 in forty-eight hours, 38 between the second and third days, 19 between the third and fourth days, 7 existing five days, 5 six days, and 4 seven days.

Duration of the disease.

The seat of wound or cicatrix rarely shows anything unusual; in three or four cases out of a hundred it may be slightly painful, irritable, or inflamed, or the seat of a neuralgic pain, the pain being a kind of "aura," as in epilepsy; in some instances this is very severe.

Condition of wound.

Diagnosis.—There is no disease like hydrophobia, taking it as a whole. In a certain sense, it resembles tetanus, yet the two diseases, in their general features, are unlike; they may, however, occur together, and so good an observer as Dr. J. W. Ogle has published a case of combined tetanus and hydrophobia in the 'British and Foreign Medico-Chir. Review,' 1868.

Diagnosis.

What Trousseau has called nervous hydrophobia may, however, be mistaken for it—true dysphagia, brought on by a dread of rabies; "but the sudden invasion of this complaint, generally coming on through the person recalling to mind or hearing the relation of a case of true hydrophobia, and the duration of the dysphagia over the period of four days, are amply sufficient to characterise the complaint, and to enable the practitioner to persuade the patient that he is suffering from mere nervous symptoms, which will vanish as soon as he ceases to fear. Besides, in nervous hydrophobia there is dysphagia only, but no general convulsions, the spasm affecting the pharynx alone, while the breathing goes on with regularity."

Marochetti's views.

In the very early period of the disease, during its incubation, Drs. Marochetti, Magistel, Xanthos, and others, have called attention to the presence of pustules or vesicles near the frænum of the tongue, known in Greece as *lyssi*, and they assert, that if these *lyssi* are cauterized, all manifestations of disease are to be prevented. Should these observations be confirmed a valuable means of diagnosis as well as treatment at the very earliest stage of the disease will have been found. These lyssi are said to show themselves at an earlier period in proportion to the amount of poison deposited in the wound. Marochetti made early incisions through the vesicles, and then cauterized the surface with a red-hot iron, and, he said, with invariable success.

Pathology.

Pathology.—There are no pathological lesions peculiar to hydrophobia—at least, none such have as yet been described. Mr. Durham, in a case that occurred at Guy's in 1865, carefully examined the cord, prepared after Dr. L. Clarke's method, and found extreme congestion of the grey matter of the cord, and numerous minute patches of extravasated blood in different sections; and more recently Dr. Benedikt, of Vienna, has made out that in dogs "the pathological process in this disease consists in acute exudative inflammation, with hyaloid degeneration, which doubtless arises from the exudative infiltration of the connective tissue of the brain." ('Wiener Mediz. Presse,' June, 1874; 'Lond. Med. Rec.,' Sept. 30, 1874.)

Treatment.

TREATMENT.—In all cases of bites from dogs or animals in which the faintest suspicion exists of rabies, free cauterization with lunar caustic should be performed. Youatt states that he adopted this practice in upwards of 400 persons, and four times on himself, with complete success, and in all these cases there was no doubt as to the dogs being mad. With such a result no other caustic need be used; when this is not at hand, any acid, caustic alkali, or cautery, will do. When the escharotic cannot be obtained the part may be excised, and during this proceeding a ligature should be fastened on the cardiac side of the wound. Some surgeons advise amputation.

Mental stimulants, in the way of giving hope and dispersing fear, must be freely administered, and such general treatment as may be needed. No drug has yet been found that has the least influence on the disease, either in preventing or curing it. Dr. Marochetti's treatment of the lyssi is the only one that approaches any sort of success. How far the constant administration of chloroform would influence the disease is a question that may fairly be put to the proof. To prevent asphxyia from taking place, tracheotomy, as suggested by Dr. Marshall Hall, is a justifiable measure; the operation is based on a good theory, although it has never been performed on the human subject. By it the immediate risk of death from asphyxia would be rendered impossible, and time given for remedies to act or the disease to run through its course. It seems six or seven days is the outside period for the disease to be in existence; if life can be prolonged thus far, the hope of a good result may be entertained. Anything that will tend to prevent death, and thus keep the patient alive, is good. Tracheotomy is one of these means, and deserves trial, wine and food being good adjuvants.

When a dog is known to be mad, it had better be destroyed; but when any one has been bitten by a dog in which no evidence of madness exists, the animal should be kept, although apart from others, and guarded, for time will prove the truth of his condition, and do away with the morbid fear of "rabies" that may have been excited by the injury.

Glanders.

Glanders.

Varieties.

This is a specific disease given to man by inoculation from the horse. Dr. Elliotson first recognised its true nature, and described it under the term Equinia. It shows itself under two forms. In one it attacks the mucous membrane of the nose and neighbouring glands—"*glanders.*" In the other it affects the lymphatics of the body generally, giving rise to tumours or a knotty condition of the subcutaneous glands, which are called "*farcy buds,*" the disease being then called "*farcy.*"

In man these two forms are generally found together.

Symptoms.

Characteristic eruption.

Virchow's view of the pustules.

There is said to be a stage of incubation varying from two to fifteen days from the inoculation, febrile symptoms with excitement then appear, followed by the specific eruption. The pains of the limbs that accompany the febrile condition are generally associated with tenderness wherever glands exist, and on examination some enlargement of these glands will be found. The eruption is very characteristic; it is made up of a crop of vesicles, becoming pustular, which are very hard and more like those of variola than anything else. They are arranged in groups, with inflamed bases, the face, neck, and abdomen being, as a rule, more covered than the extremities; when close together, they become confluent. These pustules, with their indurated bases, then soften down, leaving ulcerated excavated surfaces. They affect the mucous lining of the nose, giving rise to the discharge. Virchow says that "these so-called pustules are really due to the presence of a tenacious deposit in the corium of the skin, that has much resemblance to tubercle, and microscopically is made up of an amorphous granular appearance mixed with cell-elements, cell-growths, and fat-globules." ('Handbuch.') This opinion is supported by the clinical fact that tubercles are so often found in farcy in the subcutaneous tissue, appearing as hard circumscribed blind boils or more or less diffused swellings. These soften down and give rise to extensive sloughing of the skin and parts around; rarely being absorbed. During the progress of the disease soft tumours, not unlike pyæmic cutaneous abscesses, appear about the body, sometimes attacking deeper parts. In the more advanced stages of the disease these tubercles or so-called pustules attack the larynx and whole respiratory tract, and more particularly the lungs, giving rise to Virchow's pneumonia of glanders, this affection consisting of a series of tubercles beneath the pleura covering the lungs, surrounded by lobular pneumonic inflammation, as in pyæmia. These tubercles are said to have been found in the testicles, kidneys, pancreas, and joints.

When attacking the nose.

When these tubercles attack the nose, which they usually do at an early period, and often before they appear in other parts, the secretion from the nose is at first catarrhal, thin, and clear, subsequently thick, tenacious, and puriform, often mixed with blood, but as often as not this nasal discharge is absent or not noticed till a later period of the disease. The face and head often swell from œdema, presenting a puffy, erysipelatous, shining surface; the conjunctiva also secretes a thick secretion, gluing the eyelids. The tonsils are frequently involved, and often suppurate. As the disease progresses the swellings and discharge increase, the inflammation around spreads and becomes gangrenous, bullæ appear on the skin, the constitutional symptoms become typhoid, a low delirium sets in, and death, not unlike that from pyæmia, ensues, with coma and exhaustion. When the glands and absorbents are involved, as in the farcy form, suppuration and sloughing, with all other local conditions, are superadded to those already given.

Constitutional symptoms.

Prognosis.

The *prognosis* of glanders is most unfavorable, recovery only taking place in the mildest cases of poisoning. The disease in its acutest stage may prove fatal in a week; indeed, it has run its course in three days, but in general it lasts for three or four weeks, and in very chronic cases life has been prolonged for months. In chronic "farcy," where sloughing glands have left large sores, these may remain open for a long time; occasionally such chronic cases end by an attack of acute disease.

Post-mortem appearances.

The post-mortem appearances have been well described in two recent cases, in both of which there was absence of nasal discharge. One was Dickinson's case, and the second Poland's, from whose paper, in 'Holmes's Surg.,' vol. i, I quote. One died on the twenty-first day. The blood was found fluid, the muscles were soft and rotten, the cervical and left parotid glands suppurating, the lower part of the right lung solid with gray hepatization, its tissues completely broken down and infiltrated with purulent fluid, the left lung studded with numerous patches of a slate colour and of the size of hazel nuts.

The second patient died on the thirteenth day. There was no affection of the lymphatic glands, but suppuration in the muscles of both calves of the legs, and local abscesses in other parts of the body, chiefly in the muscles; the joints were free from suppuration; there were recent patches of lymph on the pleura, and lobular pneumonia in the base of the upper lobe of the right lung, which was in a state of grey hepatization; the lower lobes of both lungs throughout contained smaller hepatized masses; the liver was free from disease.

Abscess in muscles.

Billroth lays great stress on the presence of hæmorrhagic abscesses in the muscles as being characteristic of the pyæmia of glanders.

Mode of inoculation.

In man, the poison is generally communicated through the nasal discharge from the horse and the discharge from farcy swellings. Where the inoculation takes place in the latter method the disease in man is more of the character of farcy. It can be communicated from man to man. This poison, to be absorbed, requires, as a rule, a wound or a delicate membrane, yet cases are on record where the disease has been set up by the wiping of the face with unclean hands or cloths.

Youatt's remarks.

Youatt states that the disease is not one tenth part so common as it was, and "generally speaking, it is only found as a frequent and prevalent disease where neglect and filth and want of ventilation exist."

Glanders, writes Dr. G. Milroy ('Trans. Epidem. Soc.,' vol. i) is "a *general* as well as a *propagable* disease; it is extremely apt in some seasons to develop itself in foul, unventilated stables;" its development may, however, be controlled even to absolute prevention by the observance of simple sanitary rules.

Treatment.

TREATMENT.—To keep the patient alive and to treat symptoms upon ordinary surgical principles seem to be the best modes of practice, for there is no drug that has any influence on the disease. Abundance of fresh air should be provided with good but not too stimulating food, and tonics, such as quinine and iron; pain should be soothed by sedatives; when the nose is a source of trouble, it should be kept clean by washing, a stream of water passed through the nostril, followed by some antiseptic lotion, such as carbolic acid, Condy's fluid, or creosote; nitrate of silver solution, tannic acid, and others more stimulating, being at times of value. Where the throat troubles, it should be sponged with some nitro-muriatic acid lotion, and the chlorate of potash gargle used.

Early opening of abscesses.

Abscesses and softened tubercles should be opened early and freely, poultices and fomentations being kept on the parts. When they are very numerous, this practice is, however, a difficult one to follow. Perfect cleanliness should, of course, be observed.

Glanders in the horse.

Glanders in the horse, Mr. Youatt tells us, in his book on that animal, is chiefly to be recognised by the persistent *discharge* from the nostril and the singular *hardness* of the submaxillary gland and its adherence to the bone. These glands are not very large except at the commencement of the disease. They are neither hot nor tender, yet the adhesions are the result of an effusion of inflammatory lymph around the glands. When any doubt exists as to the nature of the disease, the inoculation of a condemned horse or ass with the nasal secretion will reproduce the disease in a few days.

Equinia mitis.

Equinia mitis is a local pustular disease affecting the hands and body of those who dress the heels of horses affected with "*grease*"—an inflammation and swelling of the heels of the horse, attended with the secretion of a thin acrid matter. It is not unlike ecthyma, but more angry; the pustules are about the size of a sixpence; they suppurate on the third day, dry up about the tenth or twelfth, forming scabs, which leave cicatrices. The disease runs its course, and is to be managed by rest and cleanliness.

SYPHILIS.

Definition.

Syphilis is a constitutional disease, the result of a specific animal poison introduced from without. Like other specific animal poisons, it is, as a rule, the result of some local inoculation; but, unlike most others, it has the peculiar power of affecting the unborn fœtus and the newly born child in a direct way from the parents. No other blood poison appears to possess this power, at any rate to the same degree, and it is important to bear this great point of difference in mind, for in all other respects there is a strong analogy between all.

Mode of its introduction.

The poison once introduced into the system, either by inheritance—*inherited syphilis*—or by some local inoculation—*acquired syphilis*—manifests its presence in its own peculiar special way, by the appearance of a somewhat irregular although characteristic chain of symptoms. These are uncertain in the period of their manifestation after the inoculation, in the order of their appearance, in their form and in their effects, yet they possess their own peculiar features. They are local and general. They run their course, yet do not eliminate the poison. They may disappear for a time to reappear in some other form. The poison may lie dormant for years, and in healthy subjects show no signs of its presence till some weakening influence has depressed the powers of its victim, and given rise to a local affection in which the practised eye will read with more or less certainty the modifying influence of an antecedent syphilitic affection. The poison for a time

Characters.

has been scotched but not killed, and in the weakness of its possessor has reasserted its power.

Effects.

Its propagation.

No other animal poisons appear to have such tenacity of existence. They produce their specific effects in a definite way and in a regular series of symptoms, and are either eliminated or destroy life; but having made their mark and run through their course, they cease to act and are innocuous; their power for harm being exhausted. The poison of syphilis, however, is so subtle that it is tolerably certain most of the secretions of a syphilitic subject are capable of producing the same disease in another; clinical experience having disproved the opinion of Hunter that syphilis could only be propagated by the secretion of a primary sore, or the proposition of Ricord, that "a chancre at the period of progress is the *only* source of the syphilitic virus." Indeed, it may fairly be asserted that a healthy woman marrying a man who has had syphilis after all symptoms have long disappeared, may give birth prematurely to a dead fœtus, to a stillborn child, or to an infant that will either at its birth or within a few weeks subsequently show symptoms of syphilis, all these results being the effects of syphilis transferred from the father. When both parents are similarly diseased the evidence is still stronger.

Modes of propagation.

Through semen.

"The semen of a diseased man deposited in the vagina of a healthy woman will, by being absorbed, and without the intervention of pregnancy, contaminate that woman with the secondary form of the disease, and that without the presence of a chancre or any open sore either on the man or the woman." (Dr. Porter, 'Dublin Journal of Med. Science,' 1857.)

Through ovum.

A healthy woman marrying a man who has had syphilis, but who has lost all symptoms of it, may acquire syphilis through a blighted ovum, or a series more or less prolonged of stillborn children, the placental circulation between the fœtal and maternal blood being the infecting medium.

By suckling.

A healthy woman giving suck to a child the subject of hereditary syphilis may acquire the disease through some fissure of the nipple, the disease locally and constitutionally manifesting its presence with all the intensity of a primary inoculation.

Through secretion of any sore.

Physiological absorption.

Again, the secretion of any true syphilitic sore, chancre, mucous tubercle, whether of the mouth, nose, anus, vulva, or penis, is capable of transferring the disease; and the syphilitic poison may probably be simply absorbed by the vessels of a part—*physiological absorption*—without giving rise to any local affection. Hunter believed this, and Lane, Marston, and Lee, have published observations that tend to support the theory.

Further, the vaccine virus taken from a syphilitic child possesses power in itself of propagating the disease. "It should never be forgotten that it is the virus which infects the system, and that the sore is the mere local lesion, and not a necessary antecedent to infection." (Committee on Syph., p. 8.) "It is impossible to predicate with absolute certainty of any given sore that it will or will not be followed by constitutional infection."—J. Lane.

It should never be forgotten that syphilis, introduced into the system, in whatever way, whether inherited or acquired from primary sores or from the secretions of a syphilitic subject, is the same poison and manifests its presence in much the same way.

Source of contagion not always made out.

It is sometimes difficult in individual cases to make out the direct source of the contagion; but recognising the fact that the virus, however diluted in one subject, may in another show itself in all its power, as if, in fact, taken from a primary sore, the explanation of most clinical facts becomes easy.

Summary of the poison.

Syphilis is an animal and a human poison, it is capable of propagation from the secretion of any syphilitic to a virgin subject in all its intensity, by some form of inoculation or by inheritance. Nothing is known of its nature, although much is of its effects. The syphilitic virus, writes Bumstead ('Venereal Dis.,' 1870), "is alone capable of infecting the system at large and of affording protection by its presence against subsequent attacks. Unlike the poison of gonorrhœa and of chancre, it is not limited to purulent matter, but exists in the blood, in the fluids of secondary lesions, in the semen, and probably in other secretions."

How, then, it may be asked, is syphilis to be recognised? Is it to be recognised in its primary inoculation, or is it only to be known by its constitutional symptoms?

Can it be recognised by the sore.

It has been already stated that most authorities are agreed upon the fact that there is no form of local sore, chancre, or inoculation, that can be said with certainty to be the inoculation of syphilis. In the cartilaginous indurated sore, with enlarged glands, there is every probability of syphilis manifesting its presence by constitutional symptoms; and in the multiple, suppurating, non-indurated chancre there is every probability of no such symptoms appearing. But in the first form no symptoms of the kind may appear, and in the second they may. Consequently, as a law, this distinction becomes of little value. Indeed, syphilis as a disease can only be known by the manifestations of its constitutional symptoms, and not by the local inoculation; in the same way as smallpox, when propagated by inoculation, is only to be recognised by the eruption, and not by the local appearances resulting from the inoculation.

Only known by its constitutional effects.

Acquired syphilis.

On acquired syphilis. Cause.

Acquired syphilis is always contracted through inoculation—the inoculation from a local chancre or sore, of some discharge from a syphilitic mucous tubercle, condyloma, or other sore, or even from the secretions of a syphilitic subject; the secretion of one form of syphilitic sore from one subject being capable of producing a chancre of another form in another subject.

Mr. John Morgan, of Dublin, from experiments, has been led to believe that "the discharge of a syphilitic female produces on *syphilitics* the sore identical with that produced from the soft sore or chancre."

Its appearance.

After inoculation a certain time usually elapses before the poison manifests its presence, this period varying from six to twelve weeks. In exceptional cases the symptoms of syphilis may appear within the month, or fail to appear for four or more months, but every week that passes after the third month without their manifestation lessens the prospect of their appearance, and when six months have gone over without syphilitic symptoms showing themselves the probabilities of their doing so are very slight.

The different forms of syphilitic inoculation will be considered under the head of chancre, &c.

Dismissing, therefore, the consideration of the inoculating medium, and the character of sore to which syphilis usually gives rise, with

Constitutional symptoms.

the simple reminder that there is no positively specific sore, the constitutional symptoms of syphilis will now claim attention; and the variety of forms they assume is very striking. They usually show themselves primarily upon the skin in the form of an eruption, or upon the mucous membrane of the alimentary canal, as indicated by sore throat, while some amount of fever and constitutional disturbance usually precedes their appearance, the "syphilitic fever" varying according to the nervous susceptibilities of the patient.

Eruption.

The skin eruption may be only a rose rash, *roseola,* giving rise to a mottling of the skin, or to a more lasting staining. It may assume the papular form, *lichen;* the pustular, *ecthyma;* the vesicular, *rupia;* the tubercular, ulcerating or non-ulcerating, or the scaly, *lepra* or *psoriasis.* Bullæ are rare, except in hereditary disease; when present they indicate a cachectic condition.

Roseola.

The mildest form of roseola may last but a few days and disappear, or leave a dusky coppery stain behind of some durability.

Lichen.

The *lichen* will soon show the copper tint, and, as it flattens down, may become a tubercle, and this a scale, the skin on the desquamation of the scale showing much the same appearance as the macula of the rose eruption.

Tubercle.

When the eruption is tubercular at the first, the same series of changes will be seen; the raised, indurated or spongy tubercle, as it withers, usually showing a scale upon its surface, and flattening down to a macula.

Lepra.

The *lepra* and *psoriasis* appear as inflamed patches, more or less extensive, as in ordinary disease, the epithelial scales varying in thickness and the fissures in depth. The psoriasis commonly appears on the palms of the hands and soles of the feet.

Coppery tint.

All these eruptions have a coppery tint, more particularly after their first appearances have faded, but what is still more characteristic, is the fact that upon the same subject several forms of eruption are often found together—the macula, papule, pustule, tubercle and scale, passing one into another.

Carmichael's theory not proved.

What it is that determines the form of the eruption at its first appearance is not known. Why syphilis in one man should manifest its presence by an eruption of mere maculæ, in another by a papular or scaly eruption, and in a third by a pustular, tubercular, or ulcerative form is not known. The theory propounded by Carmichael, that each sort of eruption has its own form of local sore or inoculation, was ingenious, but not supported by facts, and the generally received opinion is that the peculiarity or power of the infected patient has more to do with these phenomena than the nature of the poison itself. In cachectic subjects the pustular and vesicular eruptions are more prone to appear than in the robust, and an ulcerative action to accompany, or rather to follow their appearance, the base of the pustule or of the vesicle, and at times the substance of the tubercle, breaking down, and giving rise to a troublesome and spreading ulcer.

Affections of the mucous membranes.

As the *outside* skin in syphilitic subjects is attacked by eruptions, simple and ulcerative, so the *inside skin or mucous membranes* are equally involved. "Every form of syphilitic affection of the skin," writes Lee, "has its counterpart in the mucous membrane; but the appearances will be modified by the comparative thinness of the structure, by the absence of cuticle, and by the little disposition these parts have to take on the adhesive inflammation." The mucous tubercle is the more common form, as found in the organs of generation, tongue, mouth, lips, nose, palate, throat, rectum, and anus, and occasionally in other parts of the alimentary canal. It is known also in the larynx. At times these tubercles break down and ulcerate, giving rise to irregular excavated sores.

Mucous tubercle.

These moist tubercles may appear in syphilitic subjects at any part of the body where two skin surfaces are in contact associated with moisture; when they do so between the toes they are known as *rhagades;* when about the orifice of a mucous passage as a condyloma.

Rhagades.

Syphilitic sore throat may be a mere mucous patch upon its surface; at times it is an ulceration of this patch, but at others it is a distinct affection, the throat becoming swollen and of a livid colour, and rapidly passing into ulceration. These ulcers may attack the soft palate, pillars of the fauces, tonsils, or pharynx, and present every kind of appearance, shape, and character. They may be serpiginous like the trail of a snake, horse-shoe shaped or circular, superficial or excavated with sharp edges, inflamed, sloughing, or indolent. By themselves they are not typical of syphilis, however suspicious, and require other concomitant symptoms to determine the diagnosis.

Ulceration of throat.

Varieties.

The mucous patch is the most characteristic. No ulceration is typical, although the sharply cut excavated ulcer is the most so.

Mucous patch.

In hereditary syphilis this form of excavated ulcer is rare, but I have seen the perforating ulcer of the soft palate in an infected infant a month old.

Syphilitic disease of the tongue is a most troublesome affection, and it manifests itself in a variety of ways; more commonly it appears in the form of aphthous and mucous patches, ulcerating or otherwise; not unfrequently the whole thickness of the organ is infiltrated with the gummatous syphilitic material, either as an isolated nodule or as a general infiltration. When this nodule has softened down and suppurated a deep excavated sore or fissure may be left, not unlike that of cancer, and when this is sloughing or of a chronic nature the diagnosis is still more obscure. In cancer, however, there is probably a more marked local induration than in syphilis, and rarely a sharp well-defined edge. The history of the case is, moreover, different.

Syphilitic disease of the tongue.

The mucous lining of the mouth, lips, nose, &c., is also equally liable to syphilitic disease, either in the shape of aphthous and mucous patches or of ulceration, not unlike that found on the throat or tongue; indeed, the disease of one part of the mucous membrane is the same as that of all others, the local appearances and symptoms being modified only by the peculiarities of the part.

Mouth, lips, nose, &c.

In ulceration of the rectum syphilis bears an important part, and as a cause of stricture it is not rare; when present, the disease usually spreads upwards from the anus, the bowel being in some cases superficially, in others deeply infiltrated and ulcerated. This form of disease is more common in women than in men (*vide* Chapter XVI).

Ulceration of rectum.

Syphilitic disease of the periosteum shows itself in the form of nodes, rarely as a single node. If the tibia be involved several swellings exist, and the same occurs in other bones, particularly the cranium, the swelling being merely an effusion of the gummy material beneath the periosteum. When the bones are attacked the disease is mostly chronic, and too often ends in death of the part, or necrosis.

Syphilitic disease of the periosteum.

Symptoms.

In disease of the periosteum extreme tenderness and pain, with local swelling, are the chief symptoms. When the bones are implicated the pain is of a constant aching character, and this is always aggravated towards night, but there is not such swelling as in the periosteal affection, nor so much tenderness. In disease of the bones of the skull, the dura mater and brain may become secondarily affected.

Syphilitic affection of internal organs.

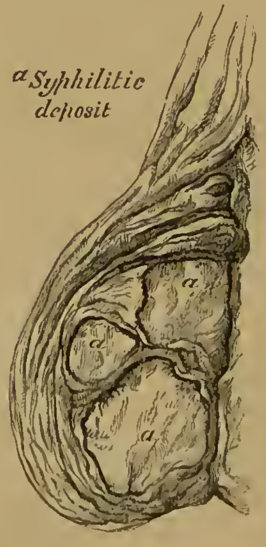
It must not be thought, however, that syphilis and its effects are confined to those parts of the body that come under the immediate notice of the Surgeon; it is hardly probable that both ends of the alimentary canal should show evidence of the affection without some part of its intermediate twenty-five feet being implicated, or without some of the compound glands that are associated with it being involved. The pathologist knows this to be the case, and modern science has confirmed Wilks' observation ('Guy's Reports,' 1863), that "the extent of the influence of syphilis is only commensurate with the tissues of the body," and "there appears to be scarcely a tissue which may not be affected, and always in one particular and characteristic manner." "The internal organs may be affected equally with the external; not only the cranium, but the brain within it, or the nerves; not only the muscles of the limbs and tongue, but the heart; not only the pharynx, but the œsophagus; not only the larynx, but the trachea, bronchi and lungs, also the liver, spleen, and other viscera."

Wilks' observation.

Effects on the system.

"The peculiar effect of syphilis on the system," says the same writer, "shows itself in a disposition to the effusion of a low form of lymph, or fibro-plastic material, in nearly every tissue of the body, occasionally modified in character to a slight extent by the organ in which it occurs. In solid organs or in the interior of the tissues there is found a more or less circumscribed deposition of an albumino-fibrous material, whilst on the surface of the body a similar material may constitute merely the base and border of an ulcer." In the testicle this is well seen (Fig. 5).

Fig. 5.



Half a testicle affected with syphilis.
2351^{55}. Prep. Guy's Hosp. Mus.

Pathology of syphilis.

In these observations the whole pathology of syphilis is included, for whether syphilis involve skin, mucous membrane, connective tissue, muscle, bone, periosteum, or a viscus, the same exudation exists, either as an exudation and induration, or as an exudation breaking up with ulceration.

Exudation.

This exudation is the same in all stages of syphilis, in all tissues, in hereditary as in acquired syphilis. When the exudation is re-absorbed a recovery is said to have taken place; when it breaks down, suppuration ensues. When it attacks the external tissues secondary symptoms are said to exist; when the internal viscera or the bones are affected, the symptoms are called tertiary.

Affection of bones and larynx.

In cachectic and feeble subjects, where visceral mischief is prone to appear, syphilitic disease of the organs may occur. The bones, if affected, are liable to become necrosed; the larynx, to ulcerate; the skin, to suppurate and ulcerate. In fact, syphilitic disease in the feeble and cachectic is as liable to be associated with disorganizing changes as any inflammatory or other affection. The longer the disease has existed also, the greater the probability of the viscera and the tissues of the body generally being involved. But in all other respects the effects of syphilis are the same. The virus, as it affects the body in all its different ways, is the same; at all times it is the same; the so-called *secondary* and *tertiary* syphilis are the same, for these terms have no definite signification; they have, I believe, tended to confuse the subject rather than clear it; they were framed when the pathology of the disease was but little known. Syphilis is clinically known by certain constitutional symptoms, and pathologically by certain morbid conditions. It may manifest its presence, in different subjects, in different ways, involving now one tissue, now another, no apparent law regulating its action. In one patient a tissue may be involved early, in another late, but the node on a bone, the nodule of lymph on the iris, the indurated gummy tumour in the connective tissue or in a muscle, the puckered nodule of fibrous tissue beneath the peritoneal covering of the liver, the mass of fibre tissue poured out in a syphilitic testicle, are all alike. They differ only in their symptoms and effects according to their position, but whether they occur soon or late after the primary inoculation is a matter of no clinical importance.

Terms "secondary and tertiary" indefinite.

Moxon's views.

"While syphilis is thus unsparingly general in its attacks upon organs, yet it plays over much the same series of organs as other diseases; vulnerable or much abused organs, which suffer disproportionately from common causes of disease, suffer also in much the same proportion from syphilis, while the thyroid, spleen, capsules, deep-seated bones, and, indeed, generally those parts which are not obnoxious to other 'common' diseases, escape also in syphilis" (Moxon, 'Med. Times,' June 24, 1871). In fact, beyond the local inoculation syphilis fixes or rather attacks an organ much as any other disease, it has no special predilection for one in preference to another, or for one tissue; the so-called secondary and tertiary affections have no real difference, they exist only in the Surgeon's mind.

Treatment of constitutional syphilis.

General remarks.

Treatment.—There is no remedy in the pharmacopœia that can be looked upon as a specific for syphilis, although there are many that have a very beneficial influence in aiding the disappearance of the symptoms; they can, however, do no more; they do not cure the disease. Indeed, it is a question whether the disease is really ever cured, whether a man who has been once under the influence of syphilis is not really like another who has been brought under the influence of vaccinia, that is, his body has been so affected by the poison as to be influenced for life. After a successful vaccination a second inoculation rarely takes as it does in a virgin subject, and after true syphilis a second attack rarely if ever ensues, Porter's law being tolerably proved, "that the influence of syphilis never returns upon itself, or re-contaminates the source from which it had been derived" ('Dublin Quart.,' 1857). Ricord, Lee, and others have proved that the soft or non-infecting chancre is the only one that can be inoculated with success on the same subject. It is true, that in a large number of cases syphilis appears to be cured, that is, the symptoms disappear and the health of the patient is re-established; but it is equally true that in such cases, after the lapse of years, even a quarter of a century, when under some weakening influence by which the powers of the patient are reduced, some local disease, such as an ulcer, appears, the existence of former syphilis is to be recognised. As long as the powers of the subject who has had syphilis remain good, no evidence exists of its presence; when they fail, the poison re-asserts its claim to recognition. It may, however, be stated with some confidence that Nature, unassisted by art, seems incapable of eliminating the disease, or of arresting its progress.

On use of mercury.

In former times the Surgeon thought that in mercury he possessed a specific against the disease, and when all chancres were looked upon as syphilitic, and mercury was given, a large proportion of supposed cures were recorded, no constitutional symptoms showing themselves.

In modern times, when it is known that at least three cases out of every four of chancres of the penis are local venereal affections, and not syphilitic, the supposed success of the mercurial plan is not recognised, although in syphilis—that is, when the constitutional evidence of the disease is present—the power of mercury in getting rid of the symptoms is indisputable.

Mercury by inunction.

Given internally.

As a suppository.

In strong and hearty subjects, therefore, when syphilis is present, either in the form of skin eruption, sore throat, or other affection of the mucous membrane of the intestinal or respiratory tract, mercury is good. The best way of using it is generally supposed to be by inunction, the rubbing in of a piece of mercurial ointment, the size of a nut, into the axilla twice a day, till the gums are touched, and after that once a day. Dr. B. G. Babington advised its being applied in adults to the soles of the feet, the rubbing in being performed by the action of walking. The internal administration of the bichloride of mercury in doses of $\frac{1}{16}$th of a grain in bark, three times a day, is a good formula for administration, as is also the green iodide of mercury in grain doses twice a day, with Dover's pill. Some Surgeons still use the blue pill with opium. During the last five or six years I have been using the mercurial suppository twice a day, and have been much pleased with its action; indeed, I am disposed to think it by far the best mode of administering mercury, it acts as well as by the mouth, and in no way interferes with digestion or the functions of the abdominal viscera. I know of no single objection to its use. Next to this plan the calomel vapour bath is the best.

Lee's calomel vapour bath.

The most convenient calomel vapour bath, writes Lee ('Holmes's Surgery,' ed. 2nd, vol. i), is one which was made at my request by Mr. Blaise. In this apparatus the lamp which sublimes the calomel boils the water at the same time. In the centre of the top, immediately over the wick of the lamp, is a small, separate, circular tin plate, upon which the calomel is placed; around this is a circular depression, which may be one third filled with boiling water; the apparatus is then placed on the ground and the lamp is lighted. The patient sits over it, with an American cloth cloak or mackintosh fastened round his neck. He thus becomes surrounded with calomel vapour, which he is generally directed to inhale for two or three separate minutes during each bath. In doing this the patient should not put his head under the cloak, but simply allow some of the vapour to escape from the upper part, and breathe it mixed with a large proportion of common air. At the expiration of a quarter of an hour or twenty minutes the calomel is volatilised and the water has boiled away—a portion of the calomel being deposited on the patient's body. The patient may then gradually unfasten his dress and put on his night dress; he must not wipe his skin. He may go to bed if he likes with the cloak and wear it. The bath should be used every night and five or ten grains evaporated.

Recently Bricheteau, Lewin, and Sigmond have employed the hypodermic injection of mercury with some success, throwing in 15 minims of a solution of corrosive sublimate, 4 grs. to the ounce of water. ('Brit. Med. Jour.,' 1869.)

Iodide of potassium.

For feeble cachectic subjects mercury, however, is ill adapted, and to these the iodide of potassium in five-grain doses, gradually raised to ten, or more, will do all that is wanted; in London practice it is generally required to be combined with some tonic, such as bark, quinine, or the iodide of iron. At times the combined use of mercury and the iodide of potassium is of great value.

When the mucous tracts are involved the addition of some alkali, such as the bicarbonate of potash, in ten-grain doses, to the iodide is of great value. The addition of the compound spirit of ammonia to the bark mixture is useful.

When the symptoms begin to go the treatment must be continued; indeed, the effects of the drugs, whatever they may be, should be kept up for at least six months after the disappearance of all symptoms, otherwise a relapse will take place.

Comparison of mercury and iodine.

Comparing the two drugs together, it may be stated that the mercurial plan of treatment is more applicable to the early symptoms of syphilis than the late; that in those of relapses, or of a remote kind, the iodide of potassium is the better drug, although under both circumstances, in exceptional cases, one plan of treatment will succeed where another fails. When the iodide of potassium cannot be tolerated, the iodide of sodium may be substituted.

Diet.

During the course of a syphilis the patient should live well, upon simple, nutritious, but non-stimulating diet; wine and beer should be given in moderate proportions; spirits should not be allowed; smoking, as a rule, should be interdicted.

Opium.

When mercury is being employed the skin should be kept warm and the feet dry, all sudden chills being bad. When suppuration or ulceration exists in any form of syphilis, mercury is rarely applicable, the iodide of potassium combined with tonics is then the best drug, with or without opium. Sarsaparilla has no specific influence in syphilis; it is a pleasant vehicle, but nothing more. Opium combined with other drugs is at times of great value; with mercury it is invaluable; it may be given in small doses whenever the nervous system has been overwrought and great irritability of pulse is present. "The soothing qualities of this admirable medicine," writes Pearson, "can scarcely be estimated too highly." In spreading ulcerations, whether due to local disease or to the expression of a constitutional symptom, opium is invaluable, either given alone or combined with the iodide of potassium. In spreading ulcerations mercury is rarely beneficial.

Treatment in affections of the mucous membrane.

The syphilitic affections of the mouth, tonsils, throat, tongue, &c., are expedited in their disappearance by the local application of the nitrate of silver, chlorate of potash, or borax lotion, while constitutional treatment is employed at the same time.

Treatment of mucous tubercles.

The mucous tubercles of the genitals and other parts are most successfully treated by the local application of calomel, the drug being dusted over the diseased surfaces through a muslin bag. A good rub with the nitrate of silver at times expedites the cure. The parts should be kept well dry.

Treatment of condylomata.

Condylomata are not so amenable to the calomel treatment as the moist tubercles; they may, however, be successfully treated by the local application of the nitrate of silver or sulphate of copper, a lotion of the bichloride of mercury gr. ij to the ounce of water, or of black wash. When very fleshy, excision is the best practice.

In ulceration of the throat the iodide of potassium, in doses varying from six to fifteen grains three times a day, is of great value, with the local application of the nitrate of silver in stick or strong solution, and alum, chlorate of potash, or borax gargle, a drachm to the pint of water.

Treatment in laryngeal disease.

In Laryngeal disease the iodide must also be given equally freely; and when ulceration has commenced, and seems to be unaffected by general treatment, the subject of tracheotomy claims serious consideration, for unless the organ of voice and respiration can be kept quiet, repair will not go on, and as long as progressive ulcerative disease exists, a sudden spasm of the larynx is imminent and also the death of the patient. The operation should, however, only be undertaken when the disease is steadily progressing in spite of treatment, and when it is clear that the larynx will be destroyed as a vocal as well as a respiratory organ unless some steps be taken to stop its progress, and of these steps there are none equal to tracheotomy, for all Surgeons are familar with the fact that even under the most extreme conditions of disease repair goes on in the larynx directly the tracheal tube has been introduced, and physiological rest is given to the organ (*vide* paper by author, 'Clin. Soc. Trans.,' 1868).

When tracheotomy advisable.

Treatment of gummy tumours.

In the *gummy tumours* of the tongue, muscles, and cellular tissue, large doses of the iodide with tonics are of great value, as they are in the *periosteal* affections following syphilis.

Treatment of internal syphilis.

There is reason, however, to believe that in the visceral as well as other diseases that may be looked upon as the sequelæ of syphilis, or as being the result of the cachexia caused by the disease and the remedies employed for its removal, the iodide of potassium alone has little influence, for Dr. Wilks has shown how the lardaceous and waxy diseases of organs are found after syphilis, and every one knows how little amenable to treatment these affections are, although Dr. Dickinson has done something to prove that these conditions are due to a want of alkalinity in the blood, and are to be prevented and in a manner cured by the medical use of alkalies. With the same view a non-nitrogenous diet should be allowed.

When iodide of potassium of value.

In the gummy period of the disease, whether it be visceral, osseous, glandular, or otherwise, the iodide of potassium in full doses is of great value. In the sequelæ, in waxy or lardaceous disease, it is of little use, alkalies with tonics being apparently the best. Upon this knowledge it is probable that the late Mr. Aston Key based his advocacy of lime water and the infusion of sarsaparilla in the syphilitic cachexia.

Hereditary Syphilis.

On hereditary syphilis.

That syphilis is capable of being propagated by hereditary transmission is a clinical fact generally recognised, and in it is found the main distinction between syphilis and all other animal poisons. How far this influence spreads is still a question under discussion; according to some observers, instead of diminishing, the radius of its action appears to be yearly increasing.

Probabilities of transmission.

That the child of a parent who has had syphilis *may, not must,* inherit the disease is generally accepted, and when both parents have been affected the probabilities of its transmission are, doubtless, strengthened; but data are still wanting to determine under what circumstances the offspring of such parent or parents is likely to be thus affected, or to be born healthy, and whether maternal or paternal influence is the greater.

There is, however, some reason to believe that when the mother is at fault the early conceptions are more likely to be blighted, and the later come to maturity; whilst when the father is at fault the first conceptions show few, if any, signs of the affection, the symptoms becoming more marked in each succeeding one, till at last the ovum becomes blighted and the wife constitutionally affected.

Daily experience, however, proves that a man who has had syphilis and lost all traces of it under treatment, who enjoys good health, and marries a healthy wife, may be blessed with healthy children, in whom no traces of syphilis can be found; and the same experience also indicates that like subjects, marrying in a less vigorous condition of health, or lapsing into it, may give rise to diseased offspring. The probabilites of the child being affected, and the degree of the affection, turn much upon the period of time that has elapsed between the disappearance of the constitutional symptoms in the parent and the date of marriage.

Lancereaux's views.

A certain number of children, writes Lancereaux, succumb in their mother's womb to syphilis, solely because they are already affected with the disease; at other times, the children come into the world with lesions unmistakeably syphilitic; whilst in the great majority of cases the child who inherits syphilis has at first the appearance of health, and, some weeks afterwards, presents signs which betray the evil transmitted to it from its parents, and it is usually from the first to the third month of extra-uterine life that syphilis manifests itself in the new-born child. Cullerier, however, gives a year as the latest time for the disease to show itself.

Symptoms of hereditary syphilis.

With respect to the symptoms of hereditary syphilis, it may be well to assert at the beginning that, with the exception of the primary inoculation, they are much the same as those of the acquired disease. Affections of the skin are found associated with those of the mucous membranes, bones, or viscera; and these affections show themselves in no definite order.

At birth the child may be plump and fat, and for some days appear healthy in all ways. After the lapse of a few days some difficulty in breathing will probably appear, with symptoms of cold in the head, and these "*snuffles*" are always suspicious. At this time, if the skin be carefully examined, more particularly about the buttocks and feet, some eruption will be seen. This eruption may be simply a staining of the skin, or a more definite papular, vesicular, or pustular rash; it may be associated with some affection of the internal skin or mucous membrane, mucous patches, or condylomata showing themselves at the anus, about the mouth or within it, around the nose, or other parts. The seat of the eruption is much determined by the amount of cleanliness observed, the irritation of dirt in syphilitic children being followed by condylomata or mucous patches.

"Snuffles."

Eruption.

Condylomata.

Fissures at orifices.

The orifices of the nose, mouth, and anus are at times fissured in a very marked manner, and at times exhibit manifestations of the disease which can never be mistaken, even years afterwards; in the annexed drawing these alterations about the face are most typical (Fig. 6).

Emaciation.

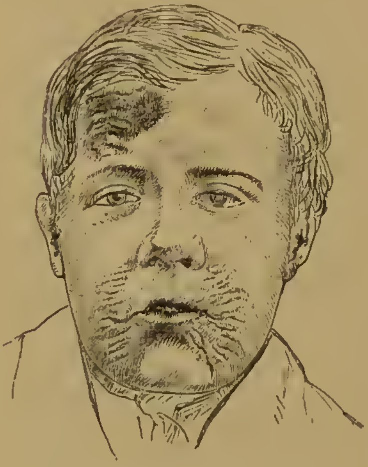
When the disease is allowed to run its course the child's general condition suffers, it becomes emaciated and puny, its digestive organs become deranged and refuse to assimilate the food, however good, that is poured into them; vomiting and diarrhœa are common consequences. Evidence of starvation soon appears, the skin becomes baggy, and of a peculiar dusky hue; when not covered or scarred with eruptions it may have a jaundiced appearance, and the child will probably die from what is called marasmus, which means wasting from starvation, the organs refusing to do the work demanded of them.

When the disease does not run so rapid a course other symptoms show themselves. It may be in the skin, bones, eye, ear, or viscera.

Affections of skin, &c. &c.

In the *skin,* subcutaneous, or submucous tissues, the disease may appear in the form of *gummy swellings* or *tumours,* which may break up and give rise to irregular excavated cellular membranous abscesses. In the *bones* the disease may show itself as nodes, and the humerus appears to be the bone the more commonly affected. I have, however, seen several instances in which the bones of the skull were frightfully involved.

Fig. 6.



Hereditary syphilis, from life.

Interstitial keratitis.

In the eye the symptoms are well known; the *interstitial keratitis,* a form of disease, according to Hutchinson, which is peculiar to hereditary syphilis, generally shows itself between the ages of eight and fifteen years. It appears as a diffused haziness of the centre of the cornea, unattended with ulceration; this haziness begins in independent patches, which subsequently coalesce, the cornea, at a later date, appearing like ground glass. The affection is attended with photophobic pain about the orbit, and sclerotic injection. It generally involves both eyes seriatim. Under treatment the disease may be arrested, but when it is severe, patches of haziness remain which interfere with vision, at times causing complete blindness. (Fig. 6.)

Iritis is also another complication, although a rare one, as is *choroiditis* and also *amaurosis.*

Deafness.

Deafness is not infrequent, the hearing failing without any external disease, such as otorrhœa. In most cases both ears are affected.

Hydrocephalus. Disease of testis.

Hydrocephalus and syphilis are also allied. *Syphilitic* disease of the testicles is also met with. I have seen several such cases, the most marked was in a boy four months old, who had snuffles and mucous patches on the lips. Each of the testicles was one and a half inches long and very hard. The disease was cured by mercurial treatment. He was the third child of syphilitic parents.

Indeed, there is reason to believe that in hereditary, as in acquired syphilis, every organ of the body in different cases may be found diseased—the viscera of the cranium, thorax, and abdomen, with the glands generally, also the skin, mucous membrane, muscles, nerves, and bones.

Exceptional cases.

How far the syphilitic poison follows the subjects who inherit it is a difficult question to decide, for it is not an uncommon event to find a child entirely free from all evidence of such a poison born of parents who had previously given birth to stillborn or diseased offspring, and in some cases even followed by a like series. A healthy child may stand alone in a long series of conceptions, a living proof of the power of life even over such a poison as syphilis.

I have also before me the notes of an instance of twins born of syphilitic parents; one went through all the series of complaints common to hereditary syphilis, and the other escaped altogether, that is, at the end of a year and a half no symptoms had appeared.

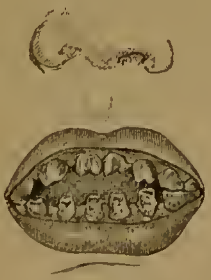
I have the notes of another case of twins, born under like circumstances, in which the symptoms appeared in one at the end of a month, and in the other at the fourth month.

Explanation of such cases.

Such cases as these would appear to show that the manifestation or non-manifestation of the symptoms of hereditary syphilis depends much upon the personal power of the child who inherits it, a strong child throwing off or eliminating the poison, while a weak one falls under its influence; for in the case of twins mentioned there can be no question as to the similarity of conditions under which they were placed. In hereditary syphilis this conclusion is founded upon strong evidence, and in the acquired it is at least probable.

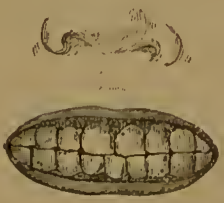
Amongst the evidences of hereditary syphilis established by Mr. Hutchinson there are often present in the permanent teeth important indications, so important, indeed, that when they are present the existence of hereditary syphilis may with some confidence be pronounced; they, however, exist only in exceptional instances of hereditary syphilis. "*The central upper incisors of the second set are the test teeth;*" these teeth are usually short and narrow, with a broad vertical notch in the edges, and their corners rounded off (Fig. 7); horizontal notches having nothing to do with syphilis.

Fig. 7.



Syphilitic Teeth.

Fig. 8.



Healthy Teeth.

Affections of the teeth.

Hutchinson's account.

"Next in value to the malformation of the teeth," writes Hutchinson, "are the state of the patient's skin, the formation of his nose, and the contour of his forehead; the skin is almost always thick, pasty, and opaque. It also shows little pits and scars, the relics of a former eruption, and at the angles of the mouth are radiating linear scars, running out into the cheeks. The bridge of the nose is almost always broader than usual and low, often it is remarkably sunk and expanded. The forehead is usually large and protuberant in the regions of the frontal eminences; often there is a well-marked broad depression a little above the eyebrows. The hair is usually dry and thin, and now and then the nails are broken and splitting into layers. Interstitial keratitis is pathognomonic of inherited taint, and when coincident with the syphilitic type of the teeth, the diagnosis is beyond a doubt.

In Fig. 6, every point in this description is illustrated except with reference to the teeth, which were unusually good.

Treatment of hereditary syphilis.

TREATMENT.—To help the disappearance of the symptoms of hereditary syphilis remedies are of great value, and in an infant that shows evidence of any constitutional power the prospects of a recovery are very good. When the child is being suckled, whether the mother shows symptoms or not, I administer my remedies, and have done so for many years, through the mother, giving her from six to ten, or sixteen grains of the iodide of potassium with quinine, or other tonic mixture, three times a day, half an hour before the child is put to the breast, and I have been much struck with the excellent results of this practice.

When child is suckling.

Mercurials.

When this process acts slowly I give the child in addition a grain of grey powder, with three or four grains of dried soda, every night. Before this I used to give the grey powder and soda twice a day, or rub in about ten grains of blue ointment every night on the soles of the child's feet, the abdomen, or the axilla, but I much prefer the practice previously laid down. In young infants the mercurial ointment may be put on the belly-band, and thus rubbed in. As the snuffles disappear, the eruption and mucous tubercles fade, the child will begin to fatten and show signs of progress. The treatment should be kept up for at least a month after the disappearance of all symptoms.

Chlorate of potash.

The chlorate of potash treatment in some instances is doubtless attended with no unfavorable result, strong infants with care and nursing battling through the disease and possibly eliminating it. But the weaker children go to the wall and die, when by more active measures they might probably have been saved; for many apparently hopeless specimens of hereditary syphilis become under treatment strong and healthy infants.

A child with hereditary syphilis should under no circumstances be suckled by any other woman than the mother, for many a healthy wet nurse has been inoculated by such a criminal practice. When the mother cannot attend to the child it should be brought up by hand.

Serpiginous ulceration.

Serpiginous ulceration is a rare and somewhat singular form of venereal disease; it would seem to be more closely connected with the local suppurating non-syphilitic sore than the syphilitic, for it is rarely if ever associated with constitutional syphilis. It usually appears in the groin or thigh after a suppurating bubo the result of a suppurating, non-syphilitic chancre, the opening in the groin spreading in crescentic patches of ulceration, one part of the sore increasing whilst a second is healing, and the cicatrix presenting a smooth glazed appearance. This

Characters.

ulceration is most obstinate, indeed medicine appears to have little or no influence on its progress, and it may so spread as to cover the thighs and lower part of the abdomen, and continue at intervals for years, at last wearing itself out. I have seen one case in which it spread as high as the umbilicus and as low as the knee. The disease at one time promises to heal and then spreads without any clear cause. It is often found in apparently healthy subjects; it seems to follow some course of its own that is not understood. It should be added that this sore is capable of being inoculated upon the same subject, the point of inoculation taking on the same action.

Capable of inoculation.

Treatment of serpiginous ulceration.

TREATMENT.—Mercury and iodide of potassium appear to have little or no influence on this affection; and if the view indicated by its course be correct, that the disease is not syphilitic, such a result is only what is to be expected. The local treatment of the sore seems to be the most important, and the best practice consists in the local application of some strong caustic, such as nitric acid, carbolic acid, or the cautery, either galvanic or actual, the patient being under the influence of some anæsthetic. Opium in moderate doses is of use, and so are tonics, but in a general way the subjects of this affection are in good health. In several instances I have found a sea voyage of more value than any other treatment; and in three the sore rapidly healed after the operation of skin grafting had been performed.

Question of marriage after syphilis.

When may a man who has had syphilis marry? is a question which is often put to Surgeons, and to answer it with any degree of confidence is no easy task, assuming, as I do, that the opinions laid down in these pages are correct, that a man who has had syphilis once is never free from its influence, and that the poison once in the body, may reveal its presence a quarter of a century after all external evidence of its existence in the form of local disease has disappeared.

A man who has had syphilis may, therefore, when he marries, so affect the ovum of his wife as to cause its death, or produce some evidence of disease, or feebleness; or if the mother be healthy and the father in good condition and free from evidence of the disease, the offspring may escape altogether and appear as healthy as that of other uninfected parents. Indeed, it would appear that if a man marries when in robust or good health a year after all evidence of the disease has vanished, he may be the father of a healthy child; but if his general condition fails and he becomes cachectic the poison seems to have the power of reasserting its influence and manifesting its presence by some feeble or even diseased condition of the subsequent offspring.

When the mother is affected with the disease the same risks are run.

Every parent who has had syphilis runs the risk of giving birth to feeble or diseased offspring; these risks are diminished by the general vigour of the parents, they are increased by diminished power. No man should marry as long as the slightest taint of the disease manifests its presence, but if in good health, and free from all evidence of its presence for a year, marriage may be contracted. To ask for a longer delay when such a step is contemplated is unfair and unnecessary; a risk must be run, and the lapse of a longer period will not lessen it.

Inoculation and Syphilization.

Ricord was the first Surgeon who employed inoculation for diagnostic purposes in venereal affections; and through his experiments he was led to the conclusion, that "a chancre at the period of progress is the

On inoculation and syphilization.

Clinical facts.

only source of the syphilitic virus." As a test of the simple suppurating sore it may now be employed, for a second sore can readily be obtained by inoculating a patient from the pus of his own primary one. Indeed, this process of auto-inoculation may be continued for a long series, but only from the suppurating sore with any effect. In the syphilitic sore no inoculation will take. And in the inoculation of common pus no reaction occurs, or next to none, a simple pustule probably alone appearing.

From these clinical facts it would appear that common pus, the pus from a suppurating non-syphilitic sore, and that from a syphilitic one, are very distinct, including under the term syphilitic any sore that is followed by syphilis.

By inoculation, therefore, a Surgeon may fairly determine the fact as to the nature of a chancre, and under some circumstances the evidence obtained by the practice may be valuable.

Syphilization.

Syphilization originated in 1844 in some experiments of M. Auzias Turenne upon animals to inoculate them with syphilis; and in these he found that, after a number of inoculations, they became proof against the syphilitic virus. It was followed up by M. Sperino, of Turin, and extensively employed by Professors Boeck, Faye, and Bidenkap, at Christiania, several hundred cases having been treated upon the principle, the object being "to cure syphilis."

Theory thereof

The theory as expressed by Boeck, "that the syphilitic virus, by continued inoculation, annihilates itself," was practically carried out by inoculating a patient the subject of syphilis with fresh matter from any active venereal sore of any kind till the inoculations failed to take. The inoculations were repeated every three or four days, first on the body, then on the extremities. When this result is met with, "the treatment is finished, and the patient has recovered his health."

Boeck's practice

Boeck never practised syphilization until the constitutional symptoms appeared, for, says he, "I cannot double a malady already present, so I am quite certain not to do harm to the patient." Sypbilization is not used with equal success against all cases of syphilis. "In those that have not been treated with mercury, the progress of syphilization will be regular; the syphilitic phenomena will vanish away, immunity will take place eventually, and recovery be attained with certainty. In those who have taken mercury syphilization is not so certainly useful; it ought to be tried; it does often cure syphilis entirely, and at least does good."

These are Boeck's conclusions; but I need hardly add, they are not those of British Surgeons. The practice has been mentioned and briefly described, but not to be recommended; it has no single advantage, and is at least loathsome. We are decidedly of opinion, write Lane and Gascoyen, in an able article on the subject, "that syphilization is not a treatment which can be recommended for adoption. We consider that, even if it could be admitted to possess all the advantages claimed for it by its advocates, its superiority over other modes of treatment, or in many instances over no treatment at all, would not sufficiently compensate for its tediousness, its painfulness, and the life-long marking which it entails upon the patient." ('Med. Chir. Trans.,' vol. l.)

The treatment not to be recommended.

Vaccino-syphilis.

Vaccino-syphilis.

That syphilis may be transferred by means of vaccination is a fact which must be honestly accepted, although where it has occurred it seems more than probable that something more than the unmixed lymph of the genuine vaccine vesicle had been employed, such as the blood of the vaccinifer; for no one can now well dispute the possibility of inoculating syphilis when the blood of a syphilitic vaccinifer is transferred with the vaccine matter to a non-syphilitic subject. Whether it be possible to transfer syphilis through unmixed vaccine lymph is still an open question. In this country such a misfortune as a syphilitic inoculation through vaccination has happily been rare, and it is only in recent days that the attention of the great body of the profession has been drawn to the subject. In Mr. Hutchinson's paper, and in the report of the Med.-Chir. Society for 1871 there will be found sufficient material to prove the truth of what has been written; and in Dr. Seaton's 'Handbook on Vaccination,' and in Dr. Ballard's work, all that is known on the subject may be read.

References.

Prevention.

To guard against the possibility of repeating these errors, the vaccinator should be careful to transfer only the unmixed vaccine matter; he should select also when possible a healthy vaccinifer, and the second child of a woman whose firstborn is healthy, and in whom there be no history of miscarriages. When any suspicion of syphilis exists in either parent the child of such parents should be set aside and not used as a vaccinifer, however healthy and perfect the vaccine vesicle may be. The cleanest instrument should be used, and the same one should never be employed for a second operation until washed. It would be also well at times to vaccinate direct from the heifer.

With the precautions above given vaccination may be regarded as a perfectly safe operation. Without them the risks of syphilitic inoculation exist, although they are very slight. They tell, however, but little against the enormous advantages of vaccination.

Lee, 'Holmes's System,' ed. 2, vol. ii.—*Marston*, 'Med.-Chir. Trans.,' vol. xlv-vi.—*Lane* and *Gascoyen*, 'Med.-Chir. Trans.,' vol. 1.—*Bumstead*, 'Edit. of Cullerier,' Philadelphia, 1868.—*Porter*, 'Dublin Quart.,' 1857.—*Lancereaux*, 'On Syphilis,' New Syd. Soc.—*Wallace*, 'On Venereal.'—*Carmichael*, 'On Venereal.'—*Hutchinson*, 'Syphilitic Diseases of Eye and Teeth.'—'Report of Committee on Venereal Diseases,' 1868.—*Turenne*, Académie des Sciences, 1850.—*Boeck*, 'Edin. Med. Journ.,' 1858.—'Dublin Journal,' 1857.

CHAPTER III.

TUMOURS.

General remarks.

In the pre-pathological period, before the minute anatomy of healthy and diseased tissues was understood, and ere the microscope had rendered intelligible subjects that still rested in darkness, *tumours* had, from necessity, been studied simply in their clinical aspects, and Surgeons, in their attempts to classify them, were guided solely by the most obvious characteristics of the growths, and by their real or fancied resemblance to the natural tissues of the body. As time advanced, more ambitious attempts at classification were made, and the most important work was that of *Abernethy*, who at the beginning of this century, published his 'Attempt to form a Classification

Abernethy's views.

of Tumours according to their *Anatomical Structures.*' In that able paper he asserted "that the structure of a tumour is sometimes like that of the part near which it grows; and sometimes unlike; that in many cases the nature of the tumour depends on its own action and organization, and merely receives nourishment from the surrounding parts;" and in saying this he gave expression to pathological truths of the greatest importance, and that still remain incontrovertible. The next real advance was due to Bichat, who recognised the essential difference between tumours, and the parasitic nature of the cysticercus and echinococcus, although by his followers this parasitic notion was carried out far too fully, for they looked upon cancer as the product of a parasitic growth of entozoa. It was left, however, to Lobstein, of Strasbourg, to embody Bichat's idea, and give it full expression, and he did this by naming tumours as *homœoplastic* that were similar in structure to the natural constituents of the body; and others as *heteroplastic* that were composed of products which differ from the normal tissues. Since that time countless workers have been examining tumours and attempting to classify them—one of the most prominent being Lebert, and to him must fairly be attributed the credit of assigning specific elements to specific tumours, each tumour having, in his eye, a definite structure; cancer was to be known by the caudate fusiform cells that even now are looked upon by some as typical of the disease. This notion of specific elements was a very taking one, for it simplified knowledge and induced men to think they had a ready means of deciding upon the nature of any new growth, and had it not been for Virchow it is probable the theory would have long held its ground; but in this learned pathologist it found an opponent of consummate power, and as his reasons for disbelieving it are the groundwork of his great book on 'Cellular Pathology and Tumours,' it is well to have them in his own words:

Bichat's views.

Lebert's views.

Virchow's views.

"In Germany the doctrine of specific elements has from the first made few proselytes, and now it is entirely abandoned. From the commencement of my career I have been compelled to combat this error, and I believe that at the present moment we are in a position to demonstrate in every direction, that there do not exist in tumours true specific elements which have no analogy with the normal tissues. It is enough for that to remember that the tumour, howsoever parasitic it may appear to be, *is always a part of the body from which it springs*, and that it is not developed in an isolated manner at the expense of some juice, at some one place in the body, by the inherent force of this productive juice. To admit such a mode of development, *de novo*, was possible at a time when it was also believed that entozoa were spontaneously developed in the body at the expense of a liquid or an excretion, by equivocal generation, when no idea had been as yet formed as to how a cysticercus arrived in the abdomen, and there was able to develop itself and grow. There was no other opinion which medical men could then form save that entozoa sprung from animal substances, either from the tissues themselves or from the intestinal mucus (*saburra*). In the present day, when it is known that entozoa always penetrate into the body from without, by a way, often it is true, extraordinary, yet always natural, this analogy can no longer be invoked. This is still more evident since we have come to know that in a free exudation there is no new element produced; that furthermore, the elements of the body itself have a legitimate origin from father and mother (or, to speak more correctly, from father or from mother, for it is a case of parthenogenesis), so that we must completely abandon the idea that a tumour can develop itself in the body as an independent being. *It is a part of the body;* it is not merely contiguous to it, but proceeds from it and is subject to its laws. *The laws of the body govern also the tumour.* This is the reason why it is not an object of natural history that one can regard as foreign from the elements of the body; it is, on the contrary, to be looked upon as embraced within its limits. . . . . Hair may make its appearance and grow at a place where we do not expect to meet with hair. But no one will fancy or believe that feathers will grow in the human body. As a matter of fact there are tumours in man which contain hair, and in cutting up geese, tumours are sometimes found containing feathers. But if ever a man engendered a tumour with feathers, or a goose, one with hair, this would be a production, *sui generis,* because the thing produced would deviate from the type inherent to the individual.

Virchow's views continued.

"*The type which in general governs the development and formation of the organism, governs equally the development and formation of its tumours.*

"There does not exist a new, different, independent type.

"What is established by logic in this manner results also from the direct observation of tumours themselves. This is why I deny that there is any heterology in the sense in which it has been maintained since Bichat's time, or such as was supposed even before then, that is to say, that a tumour could develop itself and exist in the body in accordance with some quite new plan, some new law. I go further: each species of tumour, whatever it may be, answers in its important parts to the elements of the body, the type of which is known, and the capital difference amongst divers tumours resides in this, that tissues normal in themselves appear under the form of a tumour, sometimes in regions where this tissue normally exists, sometimes in places where it does not exist in the normal state of things. In the first case I speak of it as *homology,* in the second as *heterology.*

"Wherever a normal tissue appears at a point which already contains some similar tissue, then as a consequence the new tissue is identical with the old, so that the type of the new production answers to the type of the pre-existing tissue; in this case the new tissue, the tumour, is homologous; when, on the contrary, the new type does not correspond with the old one, when it deviates from the pre-existing type, or that which is the original and normal one of the region, then there is heterology. But this latter has likewise its analogue in the body, only in another part of the body from that in which the tumour is situated.

"We cannot, in my opinion, distinguish tumours according to the tissues, in such a fashion that tumours containing certain tissues are to be regarded as homœoplastic, whilst those containing certain others are to be set down as heteroplastic; quite the contrary, *the same kind of tumour may be, under certain circumstances, homologous, and under other circumstances heterologous.* The same sort of tumour may at one time appear at a point where it is merely the expression of an excessive development of the tissue normally existing at this point, at another time at a place where this tissue is not in existence, and where its development is abnormal and strictly pathological. Let us take an example, a tumour may be formed of cartilage. The cartilaginous tumour is homologous, not because it is formed of cartilage but only if it springs from cartilage, if in this place there is cartilage already. Thus, a costal cartilage may be the point of origin of an enormous cartilaginous tumour: this is homology. But it is also possible for a cartilaginous tumour to be developed in the testis, which contains no cartilage, where this tissue should not be met with; here the same product constitutes an heterology."

On the terms homology and heterology.

Homology and heterology have, therefore, very different meanings as used by Virchow and other writers. In Virchow's language a tumour is *homologous* when it corresponds in structure with the tissue *in which it grows;* and *heterologous* when it deviates from that structure. A tumour that is homologous in one position may be heterologous in another. In the French school and others a tumour is *homologous* when built up of elements naturally existing in some tissue of the body; *heterologous* when composed of elements that deviate from the natural structures, these definitions having nothing whatever to do with the position of the tumour. In Virchow's language the terms are relative; in that of other pathologists they have a definite clinical meaning of no slight importance, for homology means innocence in a tumour, heterology malignancy. Virchow, however, admits that his heterologous tumours are suspicious, although *every heterologous tumour is not of a malignant nature.* "There are a great many such tumours borne without any ill consequences, and whose properties are quite similar to those of which the nature is benign. Malignancy follows a certain scale among heterologous tumours, from species to species; and we are able to show how it is manifested more and more strongly—for the most part following two directions. In the first place, heterology is distinguished according to the degree which it attains. The tissues of connective substance have a much nearer relationship existing among themselves than they have with epithelial tissues or with the specific animal tissues. When, therefore, a cartilaginous or bony tumour is developed in connective tissue, or even a mucous tumour in adipose tissue, that is not nearly so heterologous as when an epidermoid tumour is formed in connective tissue, or a tumour of cylindrical epithelium in a lymphatic gland. A cartilaginous tumour which is developed in connective tissue, or in the tissue of bone, is indeed heterologous, but it is not so to the same degree as an epithelial tumour or a muscular tumour would be in the same place. But a still more important circumstance is this, that tumours engender certain liquid substances which we speak of under the name of juice. This is the humour or juice of the tumour of which much has been said."

Virchow's views thereon.

"This parenchymatous juice is sometimes related to the cells, sometimes to the intercellular substance; and accordingly it appears under the form of a fluid either intracellular or intercellular, contained in the cells or interposed among them in a liquid state like serosity. Whenever a tumour contains much juice, it gives evidence of more troublesome properties, and it possesses to a high degree the property of infection. A dry tumour of the epidermoid kind is by far less dangerous than a moist one; a soft cancer is much more to be dreaded than a hard one.

"The more a tumour is poor in vessels the less it will extend its infecting action beyond the neighbouring parts; but the more it is rich in blood-vessels and lymphatics, the more it is traversed by the blood and lymph; the more the parenchymatous juices are in contact with the blood so much the more is the infection likely to become general.

Virchow's views continued.

"I give thus an interpretation of facts, but it is in accord with observation. The degree of contagiousness of tumours increases in proportion as they become more rich in vessels, and that alongside the vessels they contain an abundance of liquid materials. Every soft succulent tumour is suspicious, and that just in proportion as it contains many vessels and cells. The more the juice is intercellular and in contact with the vascular stroma of connective tissue, the more the malignant properties which are manifested by an ever new excitation to the progressive production of the tumour.

On contagiousness of tumours.

"I ought, indeed, to speak more at length as to the nature of these juices, but in truth I do not know what to say upon the subject. The results which chemists have arrived at on this subject have no kind of value. Here the field is open to inquiring and progressive spirits; and I hope that hereafter researches will be undertaken in this direction, and that they may be crowned with success."

But as this is not a work on pathology, I cannot allow myself to enter further into these speculations, and must refer the reader to Virchow's masterly work on 'Cellular Pathology and on Tumours' for a more full elucidation of the subject.

In the following pages I shall regard tumours in their clinical aspect alone, giving their anatomical characters only so far as they illustrate the practical aspects of the subject. All speculative pathological doctrines will be put aside—as tending to confuse rather than elucidate clinical phenomena—waiting for the day when pathological science shall have so far advanced as to allow of an anatomical classification of tumours being made that will dovetail in fully with that founded on clinical observation. The microscopical anatomy of tumours will be furnished by the pen of my friend and colleague Dr. Moxon.

Tumours regarded in their clinical aspect.

I purpose, here, to lay down some few pathological points which have an important clinical bearing, and which tend to illustrate the subject of the diagnosis of tumours.

A tumour may be defined to be a new growth, cystic or solid, infiltrating, separate from, or continuous with, normal tissues; it is an addition to, not an increase of, natural parts, for such is an hypertrophy; and it manifests its independent existence by its disposition to grow irrespective of the part in which it is placed. All tumours, with the exception of the hydatid, are made up of one or more of the natural elementary tissues of the body, in a rudimental or morbid state, and in no single example has any extraneous or new element been ever detected. For just as the natural body is built up of cells and fibres in one or other of their different forms, so tumours are made up of like elements, although it may be in unequal proportions. Tumours, like the natural tissues, differ, therefore, anatomically, according to the nature of the elementary structure of which they are composed; and this again appears to be materially determined by the part of the body in which they are developed.

Definition.

From this, therefore, a second leading principle may be fairly drawn, *that all tumours partake of the nature of the part in which they are developed, and are more or less made up of the elements which naturally enter into its formation.*

Deduction.

Explanation.

Wilks's remarks.

Paget's remarks.

Thus a tumour developed in the stroma of a fibrous structure will probably be fibrous; if connected with bone more or less osseous; and if situated in a gland, it will in all probability partake of the gland structure. But new growths never assume the complicated structure of a fully developed gland, they only in a degree simulate it. Wilks well expresses it that "the great difference between physiological and pathological formations appears to be that nearly all new growths are of the simplest composition, not putting on the form of the complex organs near which they may be placed, but consisting principally of cells and fibres." The cells and nuclei of a part, instead of developing into normal tissues, err in their course, multiplying and possibly growing, and "whilst conforming generally with the part in which they are placed in minute structure and composition, yet they more and more widely deviate from it in shape and size." (Paget.)

Practical bearing of the pathological principles.

The practical bearing of these pathological principles is by no means unimportant; for to the Surgeon, who has once recognised the true position of a tumour, there is a certain amount of probability as to its nature which will at once suggest itself to his mind. If the tumour be situated in the skin or subcutaneous tissue, there is a strong probability that it will be composed of some one or other of the structures of the tissue; it may be the sebaceous tumour, which is rarely found in any other position, or the fatty, for these two materials enter largely into cutaneous structures; or it may be one of the fibrous or fibro-cellular nature, fibre-tissue existing abundantly also in these parts. Should the tumour be located between the muscles of a part, the tumour will probably be composed of connective tissue elements, in the form of a sarcoma; being either a myxomatous, fibro-nucleated, or fibro-plastic tumour. Should bone, again, be the seat of the disease, some one of the elements of bone will, to a certainty, enter into its formation; the probability of its being an enchondroma, an osseous or a myeloid tumour naturally presenting itself to the mind. And, lastly, should a tumour be present in a gland, such as the breast, uterus, or prostate, the probability of its being an adenoid or glandular tumour cannot be overlooked; for pathologists now all recognise the fact of the close resemblance of tumours so situated to the natural gland structure. And even in carcinomatous tumours, if modern recorders are to be relied upon, the same principle holds good, for according to Waldeyer ('Archives,' Band xli, 1868), "Carcinoma is essentially an epithelial growth, and only occurs primarily where true epithelium already exists. Secondary carcinomata can only be produced by the direct propagation of the epithelial cells, which may be transported from their primary seat either through the lymph vessels, or as embola are carried through the blood-vessels to a suitable place where they develop like the germs of entozoa."

Division of tumours into two classes.

Tumours are either simple or cancerous, innocent or malignant; the simple or innocent approaching in their nature the more highly organized natural structures of the body, even to the perfect glandular; and the malignant or cancerous simulating the more elementary or embryonic. As the normal tissues were formed from a simple cell, and in their higher grades are but a development of that cell or those cells, so the cancerous element consists in a persistence of the simple cell type or that of the undeveloped embryonic nucleus. The group of cases called "recurrent" must be placed in an intermediate position, for while in *their earlier stages they tend to build up embryonic tissue, this subsequently becomes lost in cell proliferation.*

On the cell elements in tumours.

In proportion, therefore, to the amount of the cell element in a tumour may its cancerous tendency be determined, and the greater the proportion of the fibrous or well-developed structure the greater the probability of its nature being innocent or simple. The more a tumour simulates the natural structure of a tissue or gland, the greater is the probability of its being innocent; the more a tumour simulates the undeveloped cell structure, the greater the certainty of its being cancerous; malignancy appearing to diminish in proportion as the cells become more fully developed; and as it is in the nucleus of a cell that the active principle of its growth is to be sought, so it is clear that the more the tumour is composed of nuclei the more malignant is its nature, and the better formed the cell-wall is, so is the growth less malignant.

Cancer a purely cell tumour.

The nearer a new growth approaches, both in its elements and in the arrangements of its elements or structure, to the complex organs of the body, the greater are the probabilities of its being innocent; new growths under no circumstances coming up to the perfection of a true gland tissue. Cancer being a purely cell tumour, growing indefinitely where the least resistance is met with, and having no other than cell structure, is, says Wilks, "an objectless cell growth."

Tumours never change their original nature.

Tumours never change their original nature, nor pass on nor degenerate into others of a different kind. A simple tumour is simple to the end, and a cancerous tumour is cancerous from the beginning. The above lines are not intended, however, to convey the impression that a patient the subject of a simple tumour may not become the subject of a malignant one, or *vice versâ*, for such may unquestionably be the case; and after the removal of a simple tumour a malignant one may secondarily make its appearance. But no simple tumour by growth or degeneration will become malignant, as no malignant tumour will become innocent. It would appear, however, that in recurring innocent tumours there exists a tendency for such growths to present on each return more the elementary character of the malignant growth, and "that a tumour which, under ordinary circumstances, is loth to contaminate the system may do so under the favouring influence of a long period of time," either as a recurring tumour or as a more malignant one.

Infiltrating process in tumours.

Examples.

Simple tumours separate tissues in their growth, but never infiltrate; cancerous, as a rule, infiltrate, and rarely separate. No more important practical point than the above can be brought forward to aid the Surgeon in his diagnosis of a tumour. A simple or innocent tumour, however long it may be in growing, and however large a size it may attain, will never do more than separate the parts between and beneath which it may be developed. The bones may be absorbed by its pressure, but they will never be infiltrated; and the skin may be so stretched and attenuated by its distension as to ulcerate or burst, but it will never be infiltrated with the elements of the tumour. This fact is well exemplified by a close examination of the margin of a cutaneous opening, the result of over-distension; for it will appear as if cleanly cut, or rather punched, at its edges, and never thickened or diseased. An intra-cystic growth may project from it as a fungus, and put on many of the appearances of a cancerous tumour, yet the margin of the opening will be free, it will not be infiltrated. In the cystic tumours of the breast this clinical fact is well seen. (Fig. 353.)

Encapsuled tumours generally innocent.

Simple tumours, by expanding parts, cause the cellular tissue around them to become condensed, and to form a capsule; consequently, most of the innocent tumours are encapsuled more or less completely. With the majority of cancerous tumours, however, a very different condition has to be described, for a cancer has the peculiar property of freely infiltrating all the tissues upon which it presses, at its base, round its borders, and upon its cutaneous aspect. As the tumour approaches the surface, the integument first appears to be drawn down to it, and afterwards is as though glued to its surface (Figs. 345-6). At a later stage the skin becomes infiltrated with cancerous elements, and to the finger feels firm, fibrous, or tuberculated; and when ulceration has commenced, the edges of the skin are palpably indurated, thickened, and infiltrated with cancerous products (Fig. 352). The contrast between these different conditions of integument in the two classes of tumours is most marked and very important, forming a most valuable means of diagnosis in the extreme stage of simple or malignant tumours.

Cancer infiltrates skin, &c.

Diagnosis of simple and cancerous tumours.

Simple or innocent tumours affect the patient solely through their local influence; they grow by their own inherent properties, and irrespective of the growth of the parts in which they are placed; they have little disposition to soften down or ulcerate; they have no tendency to multiplication in other tissues, nor to involve the absorbents with which they are connected. Cancerous tumours not only affect the patient through their local influence, but have a marvellous tendency to multiplication in any part of the body. Through the lymphatic system they involve the glands of the part with which they are connected, and through the vascular system they spread to other parts; they are prone, also, to degenerate and ulcerate.

When simple tumours are multiple.

When simple tumours are multiple, they are always found in the same tissue. When cancerous tumours are multiple, they are mostly found in different tissues. Thus amongst the innocent growths, multiple fatty tumours of the skin are not uncommon; multiple fibromata of the uterus are often seen; multiple glandular tumours of the breast are met with involving one or both organs; and multiple fibroplastic or myxomatous tumours are on record. A remarkable case of this I have to record. It is not seldom that multiple enchondromatous tumours and exostoses are seen; but in all these instances the tumours occupy one tissue.

When cancerous tumours are multiple.

In the cancerous multiple tumours no such description can be given, for they spread in ever widening circles from the parent tumour, the cancerous elements spreading as freely locally in connective tissue as the floating blood-cells move through the walls of the blood passages, as a colloid is penetrated by a crystalloid, and wander about in what are called solid tissues; they follow the course of the lymphatics and affect the glands; they at times seem to follow the course of the venous circulation. They recur by continuity of tissue as from constitutional reproduction, and Mr. Moore has given us some evidence that, in a cancerous tumour within the skull, some detached fragments, which had sunk in the fluid of the arachnoid, had adhered to the spinal cord and grown. They spare no tissue or organ, but invade one and all without order or law in their destructive objectless growth.

Recurrent or intermediate tumours.

All tumours cannot, however, be divided into the *innocent* and the *malignant*, for there are some of an intermediate kind that in structure approach the innocent, but in habit the cancerous, and they show this chiefly in their *recurrence* after removal. They have been called consequently *recurrent* tumours; but as the habit of recurrence is not the only point in which they approach the cancerous tumours, it is possibly better to call them *semi-malignant.*

I propose therefore to describe tumours under these three headings:

Innocent;
Semi-malignant, or recurrent;
Malignant.

Innocent or non-malignant tumours.

These may be divided into the "*Cystic*" and the "*Solid,*" the cystic under certain conditions becoming solid by the development of intra-cystic growths.

Cysts are developed in many ways:

Cystic tumours, mode of development.

1. Some are possibly new growths, or largely developed cells, having an independent life and being capable of secreting their own contents or producing solid growths, auto-genous cysts, as Paget calls them.

2. Some are formed in an accidental way by the simple effusion of fluid into the spaces of connective or other tissues, the walls of these *false cysts* gradually consolidating, as commonly seen in bursæ and in ordinary tumours.

3. Others are produced mechanically by the dilatation of occluded ducts or natural gland-orifices, the cyst enlarging by the secretion of the ducts or gland contents: of these the mucous cysts of the mouth and vagina, the sebaceous cysts of the skin, and the milk cysts of the breast, are the best examples. Virchow calls these cysts by retention.

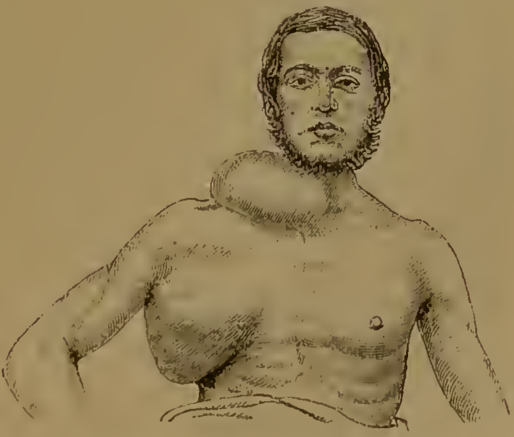
But in many cases it is impossible to make out how the cysts are formed.

Serous cysts: situation.

Serous cysts are most commonly found connected with one of the vascular glands of the body, as the kidney, ovary, thyroid, or breast, but they are not rare in the connective tissue, and are found even in bones; when seen in the neck they are described as "*hydroceles of the neck.*" Some of these are congenital, but the majority occur later in life; they appear as single or multilocular cysts, made up of thin membranous walls, lined with pavement epithelium; like a serous membrane they contain a limpid, watery, or tenacious highly albuminous

Characters.

Fig. 9.



Serous cyst of the neck. (Birkett's case.)

fluid, more or less stained with blood, occasionally holding cholesterine in suspension. These cysts are found in the neck, anywhere between the lower jaw and clavicle, beneath which they at times pass (Fig. 9); they are usually deeply seated, occasionally superficial; they give annoyance only from their size, and are painless; when inflamed, they may suppurate. They are to be recognised by their globular cystic form, soft fluctuating feel and painless increase.

Diagnosis.

Not to be confounded with thyroid cysts.

These cysts are not to be confounded with those of the *thyroid gland*, which are far more common, and at times attain a large size, and grow as quietly and painlessly as do the cervical; they have usually, however, thicker walls, are more tense, and are commonly multiple; they, moreover, move up and down with the gland on deglutition. Their contents are more viscid and are more frequently mixed with blood in variable proportions; indeed, some of these thyroid cysts are *blood cysts*, and when tapped would go on bleeding if allowed, even to the death of the patient. I have recorded such a case ('Guy's Reports,' 1864). It is probable, as Sir J. Paget has suggested, that many of the cervical cysts are thyroid in their origin, springing from some outlying portion of the gland.

Cysts are also found over the thyroid cartilage, but these mostly contain grumous blood; they rarely grow larger than half a walnut. In a case under my observation, a cyst completely covered the thyroid cartilage, and was lost on either side in the deep tissues of the neck; it existed as a soft fluctuating swelling of some years' painless formation in an adult man.

Cysts are likewise found in connection with the hyoid bone, which are possibly bursal.

Treatment of cystic tumours.

TREATMENT.—Cervical cysts had better be left alone, unless from their size they require surgical treatment, for there is always danger in dealing with any deeply seated cyst in this region from the liability of subsequent diffused inflammation of the cellular tissues of the neck. I lost a patient from this cause, some years ago, after simply tapping such a cyst.

Palliative.

When surgical treatment is called for, *palliative* means had better be primarily adopted, this treatment consisting in simply drawing off the contents of the cyst by means of a trocar and canula, or the "aspirator," and should the fluid re-collect rapidly the operation may be repeated. In performing this operation the Surgeon should guard against puncturing any of the superficial veins or deep vessels—recalling to mind their position before puncturing.

Tapping.

Should gentler measures fail even after several repetitions of the operation of tapping, the best practice is to introduce into the cavity of the cyst a drainage tube, made of perforated india-rubber tubing. When the tapping has induced some suppurative action the opening may be enlarged and the tube inserted, but in large cysts it is well to pass the tube completely through the cyst. This may readily be done by means of a long trocar and canula, such as that employed for puncturing the bladder per rectum, the pilot trocar being introduced into the cyst, after it has been opened at a dependent point, and then made to traverse the cyst, possibly beneath the sterno-mastoid muscle to the opposite side; the pilot trocar should then be removed, the drainage tube passed through the canula, and the canula taken away, the two ends of the tubing being fastened together to prevent its slipping out.

I have treated many cases of deep cervical cysts in this way and with success. I have not had one in which any bad results followed. The great point to attend to is the free escape of all pus and cyst contents; if air gets in, let the opening be free enough for it to pass out. Should fœtor appear, the cyst should be washed out daily with Condy's fluid or some other disinfectant. As the cyst contracts the tube may be removed, but as long as any cavity remains, it should be left. The passage of a seton through the cyst is another method which may be adopted; it is probably more adapted for small than for large cysts. Injecting the cyst with iodine is a third method which has proved successful. It is, however, as dangerous as any other, and not more successful. Extirpation of any large cervical cyst is a plan of treatment which should not be entertained, it is fraught with danger and difficulties.

Points to be attended to in tapping.

Seton.

Injection.

Extirpation.

Thyroid cysts may be tapped like the cervical over and over again, this simple operation being often successful for a long period, and at times permanently so. When more active treatment is called for, the injection of one or two drachms of the compound tincture of iodine or alcohol may be employed, according to the size of the cyst. When a *blood cyst* has been tapped, the flow of blood will usually cease on the removal of the canula; the tapping may cure it. In the cysts over the *thyroid cartilage* a puncture may be made, but when the fluid re-collects or is of a grumous kind an incision into the cyst in the median line appears the best practice. I have done this on several occasions with success; the scar is very slight. The treatment of cysts and tumours of the thyroid will, however, receive attention in another chapter.

Treatment of thyroid cysts.

The reader should remember that nævi, when they degenerate, commonly show cysts in their structure (Fig. 122); these are, however, usually clustered together in a cutaneous or subcutaneous group. When they appear in the neck they might be mistaken for one or other of the cysts already alluded to. The error will be prevented by recalling the fact that they occur, and by the history of the case, &c.

Nævi may degenerate into cysts.

Mucous cysts are found wherever mucous glands exist; they are caused by some obstruction to the escape of the gland contents, and contain highly tenacious mucus-like liquid albumen. They appear on the mucous membrane of the lips as *labial cysts*, small, tense, globular, painless swellings. They are found within the cheeks, upon the gum, particularly of the upper jaw and antrum, and very commonly beneath the tongue, as *sublingual mucous cysts*. Such cysts have been usually described as cases of "*ranula*." They are now known to be due to obstruction to the ducts of Rivini's mucous glands, and have nothing whatever to do with the salivary organs (Fig. 172). Such a cyst may develope about the larynx, and cause obstruction, and they have been found in the œsophagus. They are common also in the labia of women and in the vagina; as *labial* and *vaginal mucous cysts* they appear as tense, globular tumours beneath the mucous membrane of the parts. I have seen them as large as an orange. These cysts generally contain thick, ropy, mucoid fluid of a colourless or slightly yellow tint. Occasionally this fluid is mixed with blood in different proportions. I have seen them contain

On mucous cysts.

Ranula.

Vaginal and labial cysts.

black, milky or coffee-ground fluid. Sometimes these cysts inflame and suppurate, forming abscesses.

Treatment of mucous cysts.

TREATMENT.—Small labial cysts may often be turned out as a whole on dividing the mucous membrane over them, but the sublingual and larger vaginal cysts cannot be thus treated. A free opening into the cyst, and the introduction of a good plug of lint soaked in iodine, to excite suppuration, may at times suffice, but it is uncertain. In the so-called ranula it may be tried before other practice is adopted. In the sublingual, labial and vaginal cysts, I have for some years been in the habit of seizing the upper surface of the cyst with a pair of forceps or tenaculum, and cutting it off with scissors, in this way freely exposing the deeper wall. In the sublingual this practice is, as a rule, successful without further treatment, but in the labial and vaginal cysts I generally apply some caustic as the nitrate of silver freely to the exposed surface and thus destroy it, after which the wound will granulate healthily.

When these cysts can be excised the operation may be performed. The cyst must be destroyed or the secretion will go on.

The mucous cysts of the antrum and upper jaw will be described amongst the tumours of the jaw.

Cutaneous sebaceous cysts.

Causes.

Cutaneous sebaceous cysts, as they come under the notice of the Surgeon, appear as "*congenital*" and "*acquired*" tumours. They are analogous to the mucous cysts, in both instances the glands of the tissue being at fault. Some are doubtless caused, as first described by Sir A. Cooper, by the obstruction to the orifice of the sebaceous glands of the skin, for this occluded orifice may often be seen as a small depressed black umbilicated spot upon the tumour; through this orifice the contents of the cyst may often be squeezed, or into it a probe may be passed. In a larger proportion of cases, on making an attempt to raise the skin from the tumour, a dimple or evident connection between the two will become apparent, this fact revealing its nature. But in other cases no such obstructed duct or even cutaneous depression will be observed; and although the tumour may be developed within the integument, it is probably a new formation, an adenoid or glandular skin tumour.

Congenital sebaceous tumours.

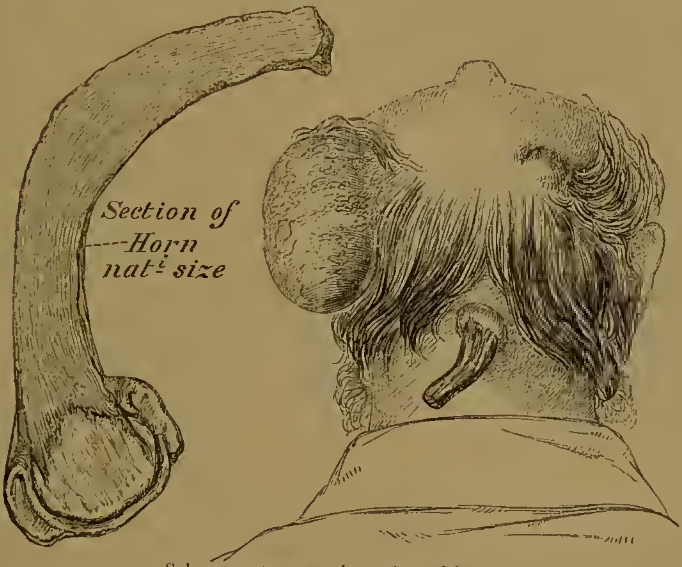
The congenital sebaceous tumours differ from those usually met with in the adult, or the acquired form, in being more deeply placed, and mostly lying beneath the fascia of the part, occasionally beneath the muscles: they are rarely cutaneous. They are more common about the orbit and brow than any other part; the external angle of the eye being their favourite seat. They appear as small, hard, semiglobular masses deeply placed; indeed, they are often upon the bone, and cases are on record in which, by their presence, they have produced perforation by absorption of the bone; in the ear this result is not rare. These cysts are thin-walled, and often contain liquid secretion; sometimes it is of a pearly whiteness, and not rarely mixed with hair. I turned a complete ball of hair out of such a cyst on one occasion, but usually the hairs are fine like eyelashes mixed with the sebaceous matter. The contents of these congenital cysts are rarely offensive.

The acquired sebaceous cyst.

The acquired sebaceous cysts may be found on any part of the body which is covered with skin. They are more common on the head and face than anywhere else, two thirds of all cases occurring in these regions: when on the scalp they are known as "*wens*" (Fig. 10).

They are always surrounded by a cyst-wall, and when enucleated from their bed this cyst-wall is always to be seen; it is composed of fibrous tissue more or less dense. In "wens," however, there is a marked peculiarity on this point which demands a notice. "The chief peculiarity consists in a thick dense horny capsule, which is closely in contact with the fibrous envelope of the original gland. This horny capsule was formerly regarded as the cyst-wall altered by pressure, until Mr. Prescott Hewett demonstrated its true relations and anatomical structure in his lecture at the College of Surgeons. It is now clearly proved that when one of these sebaceous tumours is squeezed out after the division of the skin, the fibrous cyst remains behind. This cyst can be afterwards excised, and its structure is identical with that of all the others. But the construction of the horny capsule requires explanation. If carefully examined, it is found to consist of epithelium, layer upon layer, mixed up with sebaceous matter. Sometimes a solid mass of epithelium is formed, in other instances a cavity exists in the centre, filled with soft sebaceous secretion. This capsule then seems to be a production of the epithelium of the sebaceous gland, which, being subjected to the pressure of the unyielding textures in which the tumour is developed, becomes converted by slow degrees into a tissue closely resembling horn or fibro-cartilage" (Birkett, 'Guy's Rep.,' 1859).

FIG. 10.



Sebaceous tumours in scalp and horn.

Wens.

Construction of horny capsule.

These sebaceous tumours are more common in women than in men, and are certainly hereditary. Paget says "they are certainly more commonly hereditary than are any forms of cancer."

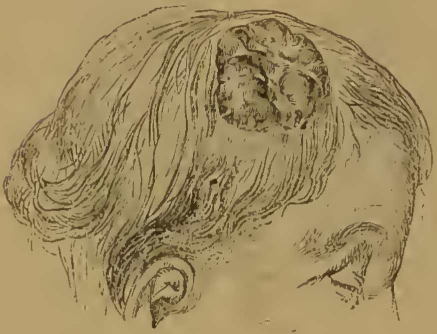
Fungating and follicular tumours.

Follicular tumours. Characters.

In neglected examples of sebaceous cyst the contents of the tumour may soften down, and causing suppuration may escape externally by ulceration. From the inner surface of the evacuated cyst a new growth may spring up, which, when forming an irregular, fungating, bleeding surface may at times put on an appearance which has been mistaken for cancer. On examining the edges of the wound, however, this mistake can hardly be long entertained, for it will be at once observed that the edges of the wound are healthy, and not infiltrated with new matter, as would be the case in a cancer (Fig. 11). This fungating growth is really composed of exuberant granulations from the cyst itself. Abernethy recognised this when he said, "I have also seen after the bursting of an encysted tumour the surrounding parts indurate and throw out a fungus, forming a disease appearing like a cancer and which could not be cured." And "it is no uncommon circumstance to meet with wens that have burst spontaneously and have thrown out a fungus, which, like a fungous body, prevents the surrounding integument from healing." The best account of the affection is by Mr. Cock ('Guy's Rep.,' 1852).

Abernethy's account.

Fig. 11.



Fungating follicular tumour.

Treatment of follicular tumours.

Points to be attended to.

Treatment.—The only correct treatment of these cysts, whether whole, broken, or fungating, is their removal. In removing "wens" or *acquired* cysts it is not necessary to be too careful in dissecting the cyst out entire, the most effective method being to slit open the tumour with a bistoury and turn it out with the forceps or handle of the knife; the cyst-wall itself is left closely connected with the skin, but no harm results. In the removal of sebaceous cysts from other parts of the body the capsule of the cyst should be taken away; in the fungating tumour the whole should be excised. In the treatment of the *congenital* tumour it is always well to try and dissect the cyst out whole; but nothing is more unsatisfactory than operating in such cases, for the cyst is always deep, its capsule thin and adherent, and any attempt to dissect it out, as a whole, is too often foiled by the bursting or puncturing of the capsule and the escape of its contents. When this happens the Surgeon must take away as much of the capsule as he can and close the wound; a good result, as a rule, follows, but at times a recurrence of the growth will take place.

When operation to be postponed.

Caustics.

The fear of erysipelas after these operations is really almost groundless: it may occur, but out of more than one hundred cases consecutively observed, I have not seen one example; pyæmia may follow this as any other minor operation, but not more frequently. When patients are cachectic, such an operation of expediency as that for the removal of a "wen" had better be postponed, for under low conditions of health blood poisoning is likely to follow; should its removal be urged, this may be done by the injection into the cyst of some caustic, such as a few drops of the deliquescent chloride of zinc, or the external application of nitric acid, or potassa fusa, to produce a slough through the skin, when the contents of the cyst may be turned or drawn out.

The dermoid cysts of the ovary are only of pathological interest, as are the dentigerous cysts of these parts. The dentigerous cyst of the jaw will be alluded to in the chapter on diseases of the jaws.

Lipomatous tumours.

Fatty tumours, otherwise called lipomata or steatomata, are very common; they are found wherever fat exists naturally in the body, and as this material is more especially deposited in the integument, it is in and beneath this that fatty tumours are most frequently met with. They occur at all periods of life, from infancy to old age, and are even congenital; they attack the male sex as well as the female, but they are three times as common in the latter; they are generally single, but occasionally multiple. I have seen a case in which the whole integument was studded with them; under these circumstances the tumours are usually small. It is impossible to assign any good cause for their development, hereditary and accidental causes have a doubtful influence. They are troublesome only from their position and the deformity they occasion (Fig. 12); at times they are the seat of pain, but such a symptom must be looked upon as an accident due to their position.

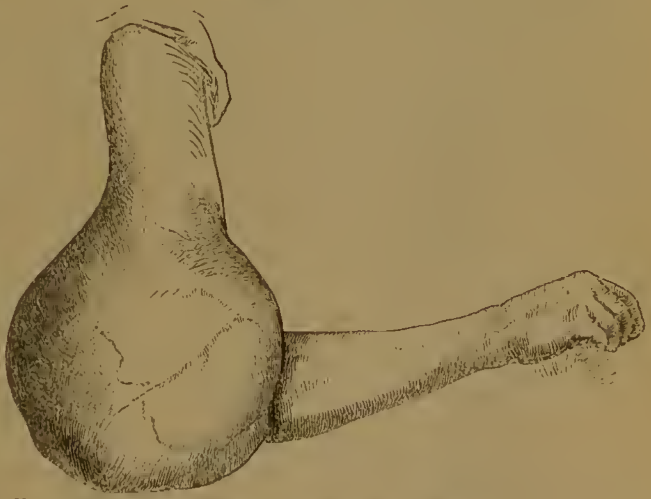
Causes.

Symptoms.

Usually encapsuled.

These tumours are, as a rule, "encapsuled;" in rare cases they are "continuous" or "diffused;" this latter variety differs only from the former in that it is made up of smaller lobules of fat, and is denser, while it is more common about the nape of the neck and face than the encapsuled variety; the large double chin is an example of the continuous lipoma, and congenital lipomata are generally of this nature. The encysted lipomata are most common on the shoulder, thigh, and trunk; some are deep-seated, as between the muscles or within the abdomen, scrotum, &c. Fatty tumours at times shift their position, that is, they drop downwards; several such cases have passed under my notice, the tumours having travelled some distance. Such an occurrence is peculiar to this form of tumour, and, when present, fixes its nature.

FIG. 12.



Fatty tumour of 37 years' growth on arm of woman, æt. 69.

Diagnosis.

The *diagnosis* is not usually a difficult task; if the tumour be deep a doubt may be felt, but, practically, the question is not of great moment, for it only refers to the nature of a simple growth, and not to its treatment. If subcutaneous, these tumours are lobulated and encysted, that is, are defined by a distinct boundary, their cyst-wall being formed by the condensed fibro-cellular tissue in which they are developed. To the hand of the examiner the tumour will feel more or less firm, and made up of lobes; when frozen by the application of ice it becomes harder; to the eye the skin will, on raising the tumour from its base and distending the skin, appear dimpled, and in parts drawn inwards towards the new growth, this dimpled aspect being typical.

Treatment.

Excision.

Barely recurrent.

TREATMENT.—When no necessity exists for their removal they should be left alone. When large and unsightly, cumbersome or growing, they should be removed by excision. A single incision through the centre of the growth is the best and most expeditious method, the tumour being pressed out from below or dragged out, the finger readily turning the cyst out of its bed. In the pendulous growth the whole should be cut off, leaving enough skin to cover the wound. After the operation the edges of the wound should be brought together by strapping and steady pressure applied; rapid union usually following. Fatty tumours, when removed, very rarely return. Curling has, however, recorded a case in which a recurrence took place, but so much connective tissue was present in that example as almost to remove it from the class of lipoma ('Path. Trans.,' vol. xviii, 1867). I have also removed from the buttock of a lady a lipoma the size of a fist, of two years' growth, from which I had removed, twelve years previously, a like tumour.

When not to be removed.

The "continuous" fatty tumour should never be removed unless under very urgent circumstances. The operation is comparatively a formidable one, so much dissection being required. In children, however, these tumours may be dealt with.

Fibrocellular tumours.

Fibrocellular and myxomatous tumours.

Myxomatous tumours.

Type of the fibrocellular.

Type of myxoma.

Intermediate varieties.

The term "*fibrocellular*" was originally given by Paget in his classical lectures on tumours to a group of new growths or outgrowths made up of tissue more or less resembling the normal fibrocellular or connective tissue of the body, and the term "*myxoma*" has been given by Virchow to the softer, looser, and more succulent or mucous variety of this group. Billroth calls this "myxosarcoma;" Müller collonema or colloid sarcoma. In the typical *fibrocellular* the tumour is firm, with a homogeneous surface on section, bands of delicate filamentous white fibre tissue intersecting its substance. Microscopically these bands are composed of fasciculi of delicate fibres of connective tissue which freely interlace; while elongated corpuscles and nuclei, varying in abundance in different specimens, are found within the fibrous meshes. The tumour is more or less œdematous, serous fluid on section draining away. In the typical *myxoma* the tumour is less firm but more elastic than the former; its nature is far less homogeneous, and presents less well-marked interlacing fasciculi of connective tissue, and from the meshes of this tissue will flow a variable stream of clear, translucent viscid mucus. Under the microscope the fibres of the connective tissue will be seen, but in smaller bundles and more drawn out, and abundance of cells, rounded, elongated, branching, and even anastomosing; these, with nuclei, will be found to fill the cavities formed by the confused network of delicate fibres of which the tumour is composed. The structure of the tumour, says Paget, closely resembles the embryonic connective tissue, or the Whartonian jelly of the umbilical cord. Between these two extremes are found in practice many intermediate varieties, the cell elements or the fibrous predominating in different proportions with the viscid mucous secretion. In the myxomata, fat often forms an important element in its structure; glandular elements may also be found, this point being determined by the position of the growth and the propinquity of a gland. Bone or cartilaginous elements are at times mixed with the others. The fibrocellular tumours are mostly outgrowths, and the different forms of softer polypi and cutaneous pendulous tumours are of this nature. The polypi of the nose are the best specimens of the looser kind of fibrocellular growths, for in consistence they vary from a watery pellucid pendulous outgrowth to a firm, more compact, and fibrous tissue. They are, however, always covered with mucous membrane with its ciliated epithelium. The softer tumours of the antrum are also of the same nature, as are the mucous polypi of the uterus, bladder, and rectum. In the rectum the fibrocellular tissue is intimately mixed with the glandular elements of the part. Amongst the fibrocellular outgrowths of the integument those of the male and female genital organs are the most common. The tropical elephantiasis scroti is of this nature. The pedunculated outgrowths of the skin are also of the same kind.

Examples of the fibrocellular.

Generally rare.

Always encapsuled.

Usually adults.

May undergo changes.

Fibrocellular growths, as deep-seated tumours, are very rare. They do occur, however, in the connective tissue of the body, the intermuscular spaces of the thigh and arm being the most common seat. They *are always surrounded by a capsule*, and, when not confined by unyielding parts, more or less ovoid; at times they are lobed. They possess a smooth outline and an elastic feel; some of the softer kinds, indeed, give the idea of fluid. They are tumours of adult life, being rarely met with in children. They increase in size with variable rapidity, the amount of fluid they contain materially affecting this point. The pendulous fibrocellular outgrowths, mucous or cutaneous, at times swell out and at others contract, those of the skin appearing shrivelled and loosely encapsuled. Those of the genital organs may attain a very large size, some being on record as weighing forty pounds. At times these tumours inflame, slough, or ulcerate, all these actions being of an indolent character, and having nothing typical.

Myxoma. Characters.

Myxomata are mostly soft, succulent tumours, made up of loose connective tissue, and more or less of their own special tenacious gelatinous secretion. They are not rare about the angle of the jaw, nose, breast, abdomen, &c. They are met with also in the extremities and in the eye. They are seen also in the delicate connective tissue of the nervous system, particularly of the brain and also of the nerves. When attacking the brain and nerves such growths are commonly found in the young; Virchow has named them *gliomata* (Fig. 23), the cells being of a small round or pointed form, embedded in granules and held together by delicate fibres. In some cases the fibre element approaches the firmer kind of fibrocellular tumours.

Glioma.

Treatment of the fibro-cellular and myxomatous tumours.

TREATMENT.—Excision is the only practice that can be followed; and although this operation need not be performed when the tumour is small and not progressing, and in aged people, it is a wise one to adopt as a general rule. Good success also usually attends the practice; in the firmer fibrocellular varieties and myxomata, a return of the tumour is not to be looked for, but in the softer myxomata where cell element predominates the risks of a return are great, the prognosis depending entirely upon the proportion of cell element existing and the succulence of the growth.

On fibrous tumours.

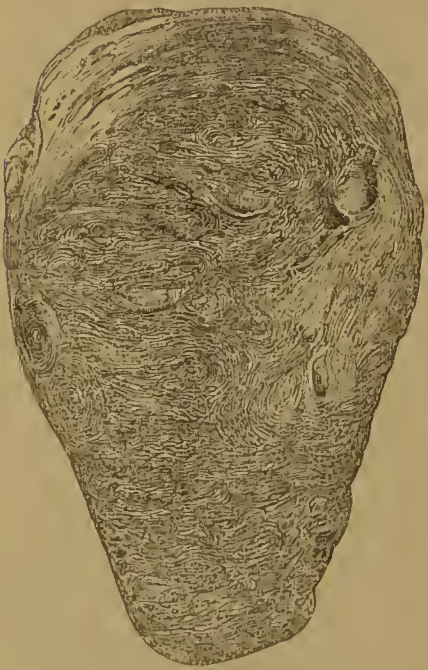
Fibrous tumours—Sarcoma.

Varieties.

Fibrous outgrowths.

This term is applicable to the denser form of tumours or outgrowths made up of fibre tissue or closely-packed connective tissue elements (Fig. 22). When mixed with the non-striped muscular fibre, the growth is known as "*fibro-muscular*," or as a "*myoma*" (Virchow's term). When associated with cysts, it is called "*fibro-cystic*," and when with calcareous matter "*fibro-calcareous*." These varieties are found chiefly in the uterus. Fibrous *outgrowths* or *polypi* are commonly met with in the uterus, pharynx, and occasionally in the rectum. They have been found in the intestine and other parts. Fibrous tumours are found likewise in the uterus and prostate, but *occasionally* in connection with the bones, periosteum, nerves, and skin. In those about the bones the elements of bone or cartilage are usually found.

Fig. 13.



Fibrous tumour.
Drawing 387^{92}, Guy's Hosp. Mus.

Fibrous outgrowths are not encapsuled.

The fibrous outgrowths have no capsule, but are continuous with the tissue from which they spring, and are made up of fibre tissue more or less closely packed and arranged in bundles or in concentric circles; they are but feebly vascular. Those of the uterus are the most typical. (Fig. 13.)

Fibrous tumours are encapsuled.

Fibrous tumours are always encapsuled, and have a tendency to assume an ovoid or globular form when not confined, but when compressed or bound down by surrounding parts, an irregular lobular shape. In structure they are very similar to the outgrowths.

Characters.

Situation

Fibrous tumours are firm, and at times most unyielding. They are slow in their increase, and give pain only from their position. When bound down by a dense fascia or situated near a nerve they cause much distress. They interfere with life or comfort simply mechanically. They are usually single except in the uterus and when in connection with the nerves. As they come under the notice of the Surgeon, those connected with the periosteum or bones are the most common, called *periosteal sarcoma,* and of all bones the jaws are the most frequently affected by them. They are chiefly periosteal and appear as outgrowths (*vide* Chapter on Tumours of Bone). They are met with in the pharynx, on the lobule of the ear, and on the nerves as "neuromata."

The subcutaneous fibrous tumour is a hard movable tumour beneath the skin. It is usually small, but when of a less dense kind and more nearly approaching the fibro-cellular tumour, it may attain a large size. Under these circumstances the skin will become part of the tumour, it will then often ulcerate and allow the growth to protrude through the opening and ulcerate or even slough, these tumours thus bleeding freely. At times these fibrous tumours seem to grow from the deep fascia.

Subcutaneous fibrous tumours.

Excision is the only treatment which offers any prospect of success, and when these fibrous tumours are removed a recurrence is rarely met with. The fibro-muscular, fibro-cystic and fibro-calcareous tumours are mostly uterine.

Treatment of fibrous tumours.

Enchondromata, or cartilaginous tumours, are most commonly met with in connection with bone; they are, next in frequency, found in the parotid or submaxillary regions, and are seen in the testicle, intermuscular septa, and other parts.

Enchondroma.

They appear, as a rule, in young subjects, in people under middle age, and my own notes tell me that they are far more common in the female than the male; they are usually slow in growth, the majority having existed years before the patient seeks advice, exceptional instances only of rapid growth being on record. These tumours, when not outgrowths, are always encysted, and have a smooth, tense, and elastic feel; in some examples they are uniform and even, in others they are bossy and nodulated; they rarely cause pain, and produce anxiety simply from their position and size. Those in the parotid or submaxillary region appear to grow superficially, and to be movable; but they often dip down deeply into the tissues, and considerable care is required in their removal; they are, as often as not, very adherent to the parts around. These simple parotid tumours rarely involve the facial nerve or cause paralysis, as the cancerous tumours do. When the cartilaginous tumours grow *within* bones they expand the osseous wall as a shell.

Usually in young persons.

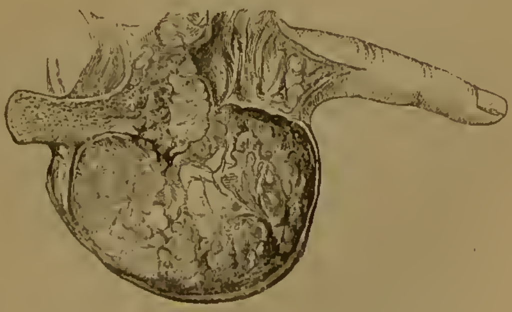
Are encysted.

Those in the parotid region.

These cartilaginous tumours are usually innocent, and consequently only separate the parts between which they are developed; they never involve the integument by infiltration, but only stretch it; in exceptional instances they excite inflammation and ulceration in the skin, with subsequent perforation; they do not affect the system through the glands, although it must be added that rare examples are on record in which cartilaginous tumours have returned and affected the lymphatic system like cancer. Paget has recorded such an instance in the 'Med.-Chir. Trans.,' 1855, and De Morgan in the 'Path. Trans.,' vol. xx.

Characters.

FIG. 14.



Section of an enchondromatous tumour expanding metacarpal bone.

The section of a cartilaginous tumour is fairly characteristic (Fig. 14); it cuts crisply and presents a smooth surface; it may appear of one

Appearance on section

mass, or made up of many lobules. In some cases the consistence of the tumour is close, and is made up of translucent or bluish masses of fœtal cartilage; this is the best seen in the periosteal forms; in others it is loose and granular, as in those expanding the bones. In many of them fibrous or glandular tissue is intimately mixed with the structure of the tumour, the parotid tumour affording the best type of this kind. In the cartilaginous tumours of bone, bone elements are always found; and in those of periosteum, fibrous elements; where glands are involved, glandular structure. When cartilaginous tumours soften down cysts are found; these cysts usually containing a dirty brown serous fluid, but they may be filled simply with broken-down tissue and pus, or a more tenacious synovial kind of fluid.

Under the microscope. *Microscopically*, cartilaginous tumours present diverse forms, simple fœtal cartilage-cells embedded in a hyaline or in a granular matrix in some cases or in others a fibrous or glandular stroma, or even both in different parts of the same growth. The most typical form is that in which the cartilage-cells are grouped together in masses, surrounded by fibre tissue, and from this type great deviations occur, the cells being, more or less, scattered between the fibres. In some instances the nuclei of the cells are free and numerous, in others they are filled with granules or oil-globules, apparently degenerating. Occasionally, the cartilage-cells are developing, and take on the mature form of bone-cells. (Fig. 21.)

Treatment. TREATMENT.—The removal of the cartilaginous growth is the only efficient treatment, but the practice must be determined by the position of the growth, and all the other points with which the tumour is clinically surrounded. When removed a return rarely takes place; cases are, however, on record, and the Guy's Museum contains a few, in which a return ensued after excision even a second or third time, but such cases are exceptional.

The cartilaginous tumours of bone will be considered amongst the diseases of bone.

Osseous tumours. **Osseous tumours** naturally come to be considered after the cartilaginous, for the two elements are usually combined; and as, in the enchondromata traces of bone may be found, so in the osseous tumours traces of cartilage may exist.

Two forms. Ivory. These tumours are found in two forms, the *cancellous bony tumour* and the *compact bony tumour*, better known under the name of ivory exostosis. The latter growth is peculiar to the bones of the skull.

Cancellous. The cancellous is almost always developed through cartilage, and made up of tissue precisely similar to the cancellous tissue of bone; in some cases it is covered with a thin casing of compact bone, like the cartilaginous tumour growing within a bone, but in most it is covered with a layer of cartilage, by the ossification of which it grows. A drawing illustrating these points will be found in the chapter dealing with exostosis. This subject in its clinical aspect will be again considered in the chapter on tumours of bone.

Myeloid tumour. Seat. **Myeloid tumours** are, as primary growths, always found associated with bone, either growing from the bone, as in "epulis," or more commonly in the bone, and when in this position usually in the articular end. The term was given to the class by Paget on account of the likeness between its cells and those of fœtal marrow. Lebert called them "fibro-plastic," Virchow "giant-celled sarcoma."

Characters.

When these tumours are periosteal they have the clinical features of a fibrous growth; when within the bone, they appear as chronic expansions of the articular extremity or shaft. When large and so expanded as to have burst through their osseous case, they appear cystic and semi-fluctuating—even pulsatile. They are usually slow in their progress, and are often painless, and it is fair to suppose that many of the cases of cystic expansion of the articular extremity of a bone are due to myeloid disease. The disease is one of youth and young adult life; and the growth is usually single. It is not connected with any cachexia or glandular enlargement as happens with cancer, and when removed rarely returns; such instances, however, have occurred: I have seen one, and Paget has recorded others.

Appearance on section.

A myeloid tumour presents in section a peculiar appearance. It may be solid or cystic in variable degrees; osseous matter, fibrous matter, or fluid may exist in different proportions; but in every specimen the cut surface will present blotches of a pomegranate crimson or of a darker blood colour, and these tints will mingle more or less regularly with those of the other tissues.

Microscopic characters.

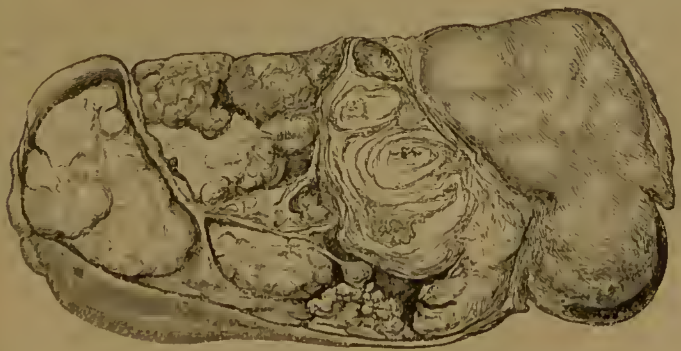
Under the microscope the characteristic polynucleated cells are seen; large, round, or irregular cells, containing many, even ten or more, oval, well-defined nucleated nuclei floating in a clear or granular substance. With these cells Lebert's caudate or spindle-shaped cells are also found (*vide* Fig. 22). These characteristic cells are found in masses or distributed throughout the tumour between the bundles of fibre tissue, and are diagnostic of myeloid disease.

On glandular or adenoid tumours.

Situation.

Glandular or adenoid tumours are new growths simulating more or less perfectly the gland structure in the neighbourhood of which they grow; they are not hypertrophics of the glands, but distinct tumours. In the breast the usual innocent tumour of the organ is of this nature, and called *adenocele*, but it is found in the prostate, uterus, lips, tonsil, thyroid and integument. They are not rare as lymphatic glandular tumours. Fig. 24 represents admirably the microscopical features of the adenomata as a class, and fig. 15 the appearance of such a tumour in section, some parts being solid and others composed of pendulous intracystic growths.

FIG. 15.



Adenoma of the breast, illustrating the pathological appearances of adenoid tumours.

Characters. Encapsuled. Appearance on section. May contain cysts. May contain cartilage or bone. Number. Growth.

They are generally growths of young life, and found during the active period of a gland's existence. They are always encapsuled, and can usually be readily turned out of their bed on dividing the capsule; they usually assume a rounded or ovoid shape, and are distinctly movable beneath the integument which is not involved. "On section," says Paget, "they commonly appear lobed, or intersected with partitions of connective tissue, and are pale, greyish or yellowish white; in some specimens looking translucent and glistening, in others opaque; in nearly all acinous or glandular. To the touch, some, especially the white and more opaque, are firm, tenacious, and elastic; others, especially the yellow and more glistening, are softish, brittle, slippery, and succulent, with fluid-like serum or synovia. Not rarely cysts are imbedded in the solid growth, and filled with serous or other fluids like those which are found in the barren cysts of the mammary gland itself. In the labial and parotid glandular tumour portions of cartilage or bone may be mixed with the glandular structure; and sometimes—chiefly in the mamma—the glandular tumours appear as if formed wholly or in part of clusters of small sessile or pendulous growths, filling cysts or partitioned spaces, thus indicating their relation to the proliferous cysts, and suggesting that they originated in such cysts. The textures around the tumour are usually quite healthy, altered only by displacement." These glandular tumours are usually single, but at times multiple. Thus in the breast they may be many, and these may be so loosely encapsuled as to move about as in a bag; in the lips they are commonly numerous; and lymphatic glandular tumours are almost always multiple. They grow with very variable rapidity, at times more slowly, at others with great speed. They require removal only from the inconvenience caused by their mechanical pressure.

Treatment.

To remove them it is only necessary to divide the capsule with the soft parts covering them in and to enucleate them. This need not, however, be done under all circumstances, for these glandular tumours not only cease to grow but at times disappear; thus operative interference should only be entertained when the growths are large or growing. Medicine does not appear to have any influence upon their increase.

The glandular tumours of special regions will receive notice in the different chapters devoted to their consideration.

Vascular and erectile tumours are considered in Chapter X.

Papillary tumours. Warts, &c.

Papillary growths or tumours require a brief notice; they are found in the outside skin, or inside skin—the mucous membrane, and instances are on record where they were found on serous membranes. On the skin they occur as warts, cauliflower or sessile, and as condylomata; some of the horny skin growths are of this nature. They occur in the mucous membranes as villous growths, and I have seen them on the hard and soft palate, tongue, rectum, and bladder; the two latter regions are indeed common seats of the affection. They seem to be a mere delicate outgrowth of subcutaneous or submucous tissue, with their natural epithelial covering, at times involving the gland structure of the part; they are usually innocent, but at times cancerous elements infiltrate the parts.

Recurrent tumours. General remarks.

Recurrent or semi-malignant growths.

It will have been observed that in nearly every group of tumours that has been described, a recurrence of the tumours after removal has been alluded to as a possible, although a rare, termination; and in this recurrence the new growths approach in character to the malignant. In some cases, doubtless, the second tumour has been simply the external manifestation of a small one that existed when the original tumour was removed, or the increased growth of a portion of diseased tissue that was left—for small tumours may often not be seen when larger are being excised—the incision of the Surgeon leaving them unexposed. On two occasions, when removing a mammary glandular tumour, I have exposed a minute growth of a similar structure by the incision made through a portion of the healthy mammary gland to reach the principal growth. In both these cases had the small tumour been left a recurrence would have been recorded. In cases of recurrent fatty tumour, or of fibro-cellular tumour, it is highly probable a small portion of the tissue was left. On one occasion, when I was enucleating a fibro-cellular tumour of several years' growth from beneath the fascia covering the scapula, I discovered two smaller which might have been overlooked and would certainly have grown. Nevertheless, it is a clinical fact that tumours, which are usually looked upon as innocent, occasionally recur; and the more the cell elements predominate in a new growth, the greater its succulence, and the looser its structure, so much the more does it appear prone to return. Each tumour as it recurs also generally becomes less solid, more succulent, and more rapid in its growth; with each recurrence the cell elements increase in proportion, and in all ways; "later formed tumours assume more of the character of malignancy than the earlier." Paget named all these recurrent tumours "recurrent fibroid," and these are usually composed of elongated, oat-shaped, caudate, nucleated cells, like the so-called "fibroplastic" cells, which are found in granulation and embryonic connective tissue. Virchow calls this tumour "sarcoma" (*vide* Fig. 22).

Liable to fallacy.

Explanation of the recurrency.

Recurrent fibroid of Paget.

Sarcoma of Virchow.

It must be observed that these tumours, as a rule, attack the young and healthy; they grow from a fascia or aponeurosis, are of slow growth, particularly at first, and destroy life only after many years, and from local causes. They return either in the spot from which they originally sprang, or from its immediate neighbourhood. They affect the part simply mechanically, by separating and surrounding tissues, but never by infiltrating them; the skin is stretched over the tumour, but never involved in it; and if destroyed it is by ulceration from over-distension, while the absorbent glands are never secondarily involved, even in extreme conditions. Such tumours are to the hand more or less fibrous and lobulated, their fibrous feel being much influenced by their rapidity of growth. When cut into they present a more or less compact surface, a clear serous fluid infiltrating its meshes; and even the finest microscopical section will be found tough and tenacious, and incapable of being pressed into a diffluent mass. Under the microscope they present an excess of nucleated cells and nucleated fibres, this, again, showing their tendency towards the characters of the malignant growth.

Characters of recurrent tumours.

Appearances on section and under the microscope.

The treatment of recurrent tumours need not differ from that of the innocent, for as long as the disease is a local one, there is a reasonable hope that it will at last fail to recur after removal. "Paget has known cases in which recurrence ceased for at least seven years after a fourth and a sixth operation; and after every operation the patient may expect to enjoy a period of comfort. Dr. Esmarch, of Kiel, told Paget

Treatment.

Prognosis.

that he had seen cases of recurrent fibroid tumour cured, and not again returning, in patients who took large doses of iodide of potassium for several weeks. Generally, however, the prognosis of recurrent tumours must be unfavorable unless Dr. Esmarch's plan prove often curative. The ordinary course is that the tumours constantly recurring grow more rapidly; leave shorter intervals of health, protrude sooner, bleed and discharge ichor more freely, and affect deeper and deeper structures, till excision becomes too dangerous, and the patient dies exhausted" ('Holmes,' vol. i, ed. 2).

Cancerous tumours.

On cancerous tumours.

What is a cancerous tumour? of what is it composed? and how is it to be recognised? are three questions which the student is constantly asking, and there are few which are more difficult to answer with accuracy or precision.

Pathological condition.

Pathologically, a cancerous tumour is *not* composed of any definite or characteristic elements, such as at once stamp it as being a cancer; it does not contain any distinct cancer cells which mark its nature, for the cells, nuclei, and fibres, which enter into the formation of a cancer may all be traced in other and in innocent morbid growths. "But neither in tumours of innocent character, nor in natural tissue, do these elements combine in such variety as is common in a single cancer" (Moore). It does not appear, however, to be incorrect to assert that the more the cell elements predominate in a growth, and the more they approach an epithelial type, the greater is the probability of its being malignant, and therefore cancerous; for the soft cancers, which are undoubtedly the most virulent, are made up almost entirely of cells and nuclei—only enough fibre tissue existing to bind and hold these cells together.

Affinity of the recurrent and fibro-nucleated tumours.

It has been already shown how the so-called innocent tumour approaches the malignant in some of its features; and it will have been observed that these which form the intermediate links between the innocent and malignant, structurally approach the latter, in having more of the cell elements in their composition. The fibro-nucleated and recurrent tumours exist as proofs of this.

But these points touch only the anatomy of those growths, and not their symptoms; they do not assist the Surgeon to make out before its removal whether the tumour be a cancer or not.

Symptoms.

What, then, are the external and general symptoms by which this point can be determined? And here it must be stated that in making a diagnosis the history and progress of the disease is at least as important as the physical characters of the tumour.

Infiltration as evidence.

If a tumour is found in a part, *infiltrating the tissues* with which it is in contact, there can be little if any doubt as to its being a cancer, for no innocent growth infiltrates tissues—it simply separates them. This question of infiltration of a part, or merely separation of it, is most important, and is, doubtless, one of the most valuable means we possess for the purposes of a correct diagnosis (Fig. 348).

Cancer may not always infiltrate.

A cancerous tumour does not, however, always infiltrate a part, although an infiltrating tumour is almost always a cancerous one; for it may appear as a distinct and isolated growth, being then, in surgical language, described as tuberous (Fig. 349). What, then, are the symptoms by which a tuberous cancer may be known? And first of all.

has the tumour itself any peculiarities by which its nature may be recognised? Unfortunately, a negative answer must be given to this question, for although it may not be an unfair thing to suspect the presence of a cancer when the tumour does not present any of the special appearances or symptoms which commonly characterise the innocent growths, it can only be a suspicion, as many innocent tumours are often deficient in the special symptoms, which, when present, readily attest their true nature.

Has no special appearances or symptoms.

A subcutaneous tumour, unconnected with the integument, with an irregular bossy outline, and of a firm, fibrous feel, will, in all probability, be of a simple nature, for these are not the characters of a malignant one; but a tumour with a smooth uniform external surface may be either a simple or malignant growth. If, however, any adhesion or drawing in of the integument to the surface of the growth can be detected, or any immobility of the tumour upon the parts beneath, the suspicion of its being a cancer may be entertained (Figs. 345, 346, and 347); for I have already alluded to the tendency which the malignant tumour possesses to involve the tissues in its neighbourhood, and have remarked that this tendency does not belong to the innocent growths.

Tendency to involve neighbouring tissues.

To produce enlargement of lymphatic glands.

But we will now pass on to another symptom, which, if present, is most characteristic of the cancer; and that is, a secondary glandular, lymphatic enlargement. If this symptom be present, the probabilities of a tumour being cancerous become very strong, for innocent and non-malignant tumours are rarely, if ever, attended with enlarged lymphatic glands.

Presumptive evidence.

A distinct and isolated tumour, therefore, which does not possess any of the special characters of a simple growth; which is attended with some evidence of secondary affection or infiltration of the parts, and with which an enlargement of the lymphatic glands in its neighbourhood exists, may safely be regarded as cancerous. It is, however, only in the early stages of the development of a tumour that a difficulty in diagnosis is usually felt, for in the long-standing and well-developed growth the diagnosis, as a rule, is not difficult.

Soft or medullary cancer.

Characters.

The soft and so-called medullary cancer is the form which is usually met with during young life; it makes its appearance generally suddenly, and often after the receipt of some blow or injury; it grows very rapidly, and presents a surface which is, as a rule, smooth and uniform, or of a semi-solid and fluctuating feel, and with large full veins wandering across. It is known by its sudden appearance, rapid growth, and uniform surface, points very different to those which simple tumours present, innocent growths being generally slow in their development, and more marked in their outline. The cases of medullary or soft cancer run their course very rapidly, and destroy life within a very short period of their development.

Hard cancer.

Characters.

The hard cancers are the affections of middle age and adult life. They grow more rapidly than the innocent growths, seldom requiring more than a few months to establish their true nature; they seldom put on the external appearances of a simple tumour, and never exist long without assuming features which are more specially characteristic of cancer, the implication of neighbouring tissues and secondary glandular enlargements being the chief points.

A *cancerous tumour* has therefore these peculiarities:

Summary.

1. It has the peculiar power of infiltrating every tissue as it encroaches upon it.

2. It spreads to the lymphatic glands of the neighbourhood through the absorbents.

3. It affects the body generally through the vascular system, in this way giving rise to secondary deposits, that is to say, to the development of similar growths in the viscera or remote parts, the lungs and liver being particularly prone to its attack.

4. It is prone to recur after removal.

Varieties of terms employed.

Cancerous tumours have been variously described by authors; the *hard*, as scirrhous or fibrous; the *soft*, as medullary; the *open, bleeding, soft* cancer, as "fungus hæmatodes;" the *black*, as melanotic; *skin* and allied cancers, as epithelial; *bone* cancers, as osteoid.

But all have the four special peculiarities that have been described as characterising a cancer.

In these pages the cancers will be considered as scirrhous, medullary, melanotic, epithelial, osteoid.

Scirrhous cancer.

Mode of progress.

Scirrhous cancer is the most common; it is the usual form found in the female breast; it is seen in the testicle, tonsil, skin, bone, eye, rectum, or any tissue. It is the hard or fibrous form of cancer—"carcinoma fibrosum." When attacking a tissue either by infiltration (the most usual method) or deposition, it gradually encroaches upon the tissue; when this is a soft one it causes its contraction as in the breast. The disease spreads outwards, and soon takes possession of neighbouring structures by infiltrating them. In this way it becomes gradually less movable, and at last fixed. No structures resist its influence—fat, skin, muscles, and bones becoming filled with cancerous elements as the disease progresses. It is said "to increase most on the side of the chief arterial supply, and in that towards which by lymphatics and veins its constituent fluids most easily filter" (Moore).

No structures resist.

Glands involved.

Sloughing of the tumour.

Ulceration.

Termination.

Thus the lymphatic glands become enlarged, and these in their turn may press upon nerves and cause pain, or upon veins and produce œdema. But cancers have not the power of living like innocent tumours; they are apt to degenerate and die; and thus, after a time, a cancerous tumour may soften down in its centre and burst, or die as a whole and slough out, or its surface may ulcerate. But, whatever happens, the disease still spreads in the neighbouring parts; indeed, after the sloughing of a cancerous tumour, this spreading action in the bed from which it has been enucleated seems to be more rapid. Thus, the death of one part of a tumour is seen with the rapid increase of another part, and in this way the disease goes on encroaching upon and infiltrating and destroying all tissues in their turn, destroying life either by exhaustion, hæmorrhage, or some internal complication.

When skin is infiltrated.

In some instances of cancer the integument over the tumour, or about it, before ulceration occurs, becomes infiltrated with small shot-like tubercles; such a tubercle feels to the finger in its early stage like a foreign body introduced into the cutis; as this grows it appears as a distinct skin tubercle. No clinical symptom is more characteristic of cancer than the presence of these skin tubercles.

Brawny condition of skin.

In other instances the whole integument becomes œdematous and brawny, infiltrated, in fact, with cancerous elements, and when this occurs the most rapid form of cancer is present. This brawny condition of integument commonly follows venous obstruction from glandular enlargement, but at times it takes place before any such complication. In rarer cases the cancer withers, "atrophic cancer," the disease slowly progressing to a point and then disappearing by a gradual process. In this way cancerous tubercles will appear and disappear; cancerous nodules will form and fall off by the contraction of their own fibres. In this way cancer may become cured, or so stationary as not to interfere with life. I have had a case under observation in which the disease existed for twenty-three years, and seemed still local. I have recorded another in which the disease lasted twelve years, appearing and crumbling away almost to a perfect cure at times during that period. Cancers display a very variable degree of growing or existing power; and there does not seem to be any condition of the patient or the tumour that either favours or disfavours these properties.

Cancer may become atrophic.

Variety in rapidity of growth.

Some have an apparent vigour of increase that is remarkable, whilst others show no such tendency; and in many cases a tumour that has been quiescent for a long period will suddenly increase actively.

The same thing may be said as regards the *cancerous ulcer*. In the atrophic form of cancer this may be merely a superficial loss of substance on the surface of the tumour, which may be covered with a scab or present a glazed or very slightly discharging surface. In other cases the ulcer will present an irregular surface with an elevated everted edge infiltrated with new tissue (Fig. 18).

Cancerous ulceration.

When a cavity exists, formed by the softening down of the centre of the tumour or enucleation of dead tissue, the irregular outline of the cavity, the fœtid semipurulent sanious discharge, the ragged and infiltrated edge of the wound are characteristic signs of its cancerous nature.

When a cavity exists.

In these cases a cachexia becomes visible, a pale bloodless haggard look of sorrow and suffering, brought on by pain, sleeplessness and exhausting discharges.

Cachexia.

Pain in the development of a cancer is a very variable symptom. In primary growths it is rarely severe, unless some nerve trunk be pressed upon, or the tumour is bound down by a tense fascia or is developed within a bone. Under all these circumstances the pain is constant, of an "aching or of a so-called rheumatic kind." In others it is usually compared to an occasional dart of pain through the part.

Pain as a symptom.

As a sign of secondary deposits pain is a valuable symptom, neuralgic pain following the course of any nerve being enough to excite fear of some deep-seated secondary growth. No more valuable or reliable clinical symptom exists than this.

The *section* of a scirrhous cancer is generally attended with a grating sensation, the parts cutting crisply; it presents a *concave surface*, and yields on scraping a milky juice. It has no defined margin, the diseased and healthy tissues, as it were, dipping into each other. The surface of the cut portion may be vascular or bloodless, and present a bluish-grey or streaked yellow aspect, according to the amount of cell or fibre elements entering into its formation, or its progress towards degeneration; the yellow spots being indicative of degeneration. Occasionally cysts or rather cavities containing serum, blood, or broken-down tissues are found in the tumour, and at other times creamy saponified masses of degenerated tissue.

Section of scirrhous cancer.

The microscopical appearances of carcinomata are well shown in Fig. 25.

On medullary cancer.

Medullary cancer, like the scirrhous, is either *infiltrating* or *tuberous*, and possesses, to a high degree, all the cancerous peculiarities. It is, doubtless, only a form of cancer and not distinct from the scirrhous varieties; for both often coexist, and the hardest primary cancer is generally followed by the soft in its secondary local or other growths. Medullary cancer is, however, the special form that appears as a congenital tumour attacking children and young adults; it may be called "the cancer of young life." These growths form very rapidly and run their course far more quickly than the harder kind. They increase so fast that they push the tissues with which they are surrounded away, more like the innocent tumours which separate them; their capsules prevent that general infiltration of the parts such as is found in the infiltrating form. It is found, although rarely, in the breast, but more frequently in the intercellular tissue, and about the periosteum and bones. It is the usual form in the eye, uterus, tonsil, testis, and ovary; the bones and cavities of the head and face appear particularly prone to its attack.

Rapid growth.

Situation.

Characters.

These soft cancers usually appear as deep-seated swellings; when not bound down by fascia or connected with bone they are rarely painful; when so situated a gnawing pain or ache is then a frequent concomitant. As they advance and become more visible, they may either present a nodular lobulated aspect, or a smooth and uniform one; but under both circumstances the integument covering in the growth will be traversed by many very large and dilated veins; in some instances the growth has a bluish congested aspect, as if filled with venous blood (Fig. 347). These tumours are often so vascular as to pulsate and thus simulate an aneurism; such a symptom, however, is mostly observed in those connected with bone.

External appearance.

Vascularity.

Soft fluctuating feel.

To the hand the swelling feels soft and fluctuating, often giving the idea of fluid, and should the Surgeon, to satisfy himself upon this point, puncture the tumour with an exploring needle, blood will freely escape and with it some creamy tissue, which under the microscope will be seen to be made up of cells and nuclei.

When bursting through fascia.

When these soft cancers have burst through their fascial envelopes they grow more rapidly, and when they have made their way through the skin they, as it were, pulp out, and project much as a hernia cerebri does after compound fracture of the skull, and bleed; the soft succulent granulations and blood-infiltrated tissues that project suggested to Mr. Hey, of Leeds, the term "fungus hæmatodes." When a soft cancer is filled with blood it is known as a "hæmatoid variety."

Fungus hæmatodes.

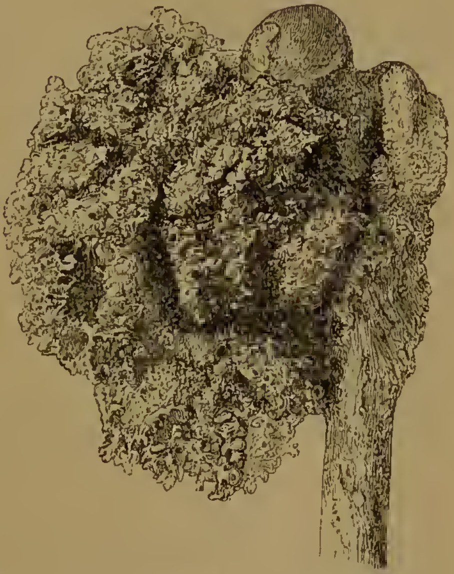
When originating in fibre tissue and bone.

When this form of cancer springs from fibrous tissue, or periosteum, it is often separated into sections by bands of fibres, and when it originates in bone it may be similarly divided by thin plates or outgrowths of ossific matter; these plates or laminæ being sometimes distinctly separate, at others so closely packed together as to form as it were a skeleton tumour (Fig. 16), the cancerous elements clothing the bony outgrowths or surrounding and covering them in. For diagnostic purposes the detection of these bony plates is of great value. Cancer may, however, attack bone in other ways (*vide* Chapter XXXII).

When attacking the lymphatics.

In cancer of the lymphatic glands these tumours develope to a large size. In the neck, axilla, and abdomen they appear when fully formed as fixed semifluctuating growths with the ordinary characteristics already described; at first they may be as movable as any gland. When they appear in the parotid region they usually if not always produce paralysis of the facial nerve; a clinical symptom I think I may say never found in the ordinary innocent parotid tumour; when present, therefore, this symptom is of value. As a rule, however, this soft cancer surrounds nerves and vessels without materially pressing upon them; large vessels and nerves being often found passing completely through their substance.

FIG. 16.



Cancer of bone. (Prep. Guy's Mus.)

Appearance on section.

The section of a soft cancer differs from that of a hard, as the "infiltrating" differs from the "tuberous" (compare Figs. 348 and 349); and differs likewise very materially in itself at different times. It may be firm or nearly fluid; it may be white and creamy, or red and blood-stained. It may be soft from inflammatory action or degenerating from natural decay.

Lobulated.

Under all circumstances it will, however, be divided into lobules; fibrous septa or fibrous envelopes separating these lobules from one another, as the fibrous capsule of the parent growth separated it from the other tissues.

Material composing these cancers.

The material composing these cancers, says Paget, "is a peculiar, soft, close-textured substance, having very little toughness, easily crushed and spread out by compression with the fingers. It is very often truly brainlike, most like fœtal brain, or like adult brain partially decomposed and crushed. Many specimens are, however, much softer than brain, and many, though of nearly the consistence of brain, are unlike it, being grumous, pulpy, shreddy, or spongy, like a placenta with fine soft filaments. Very few have a distinct appearance of fibrous or other regular structure."

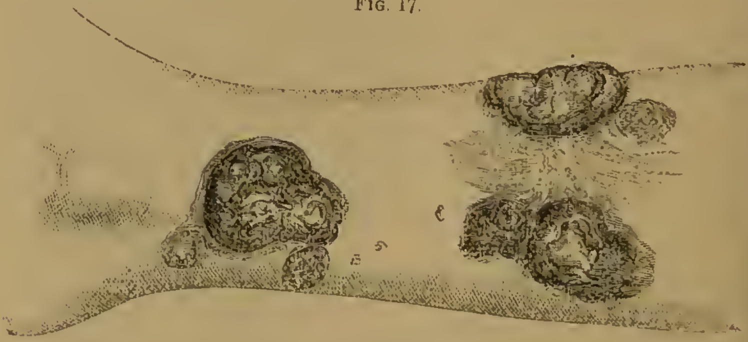
Yield juice on pressure.

These tumours when pressed or scraped yield abundant "cancer juice," and this juice is generally diffusible in water. No better rough test, says Paget, exists for the diagnosis of medullary cancers than this. The stroma of this cancer element is filamentous, and more or less condensed; it is generally very vascular. The cell element always predominates, but these cells differ in no way in character from those found in the fibrous or scirrhous form. They are less closely packed together, and seem to be suspended in the juices of the growth or enclosed within its delicate connective tissue (Fig. 25).

Melanoid or melanotic cancer is essentially a medullary cancer con-

On melanotic cancers. Situation. Their peculiarity. taining pigment, having its origin in a natural tissue, as in the choroid of the eye, or in a mole, in which pigment exists; but what it is that determines the development of these growths in tissues that have had a lifelong existence has still to be explained. The black cancers have, however, one peculiarity, and that is in their tendency to multiplicity—in this they are often most remarkable—the skin and subcutaneous tissue at times becoming studded with melanoid growths of all sizes and shades of colours. Fig. 17 is taken from a woman over whose whole body melanotic cancerous tumours were distributed, the disease having originated in a mole which I had previously excised.

FIG. 17.



Melanotic cancer. (From Model, Guy's Mus.)

Pathology. If it were necessary to adduce a forcible illustration of the fact that a cancer when first developed in a part partakes, in a measure, of the nature and peculiarities of that part, and even when repeating itself in the lymphatic glands and internal organs, still preserves the characters which it originally acquired from the seat of its primary development, no better one could be adduced than that derived from the natural history of primary and secondary melanotic growths: for Situation. a melanotic cancer always grows from a part which naturally contains pigment, and a mole is unquestionably its commonest seat, and pigment in some of its forms is almost always to be met with in all its secondary growths. It may be, perhaps, that the secondary glandular enlargements, in their rapidity of growth, outstrip the tumour from which they originally imbibed their peculiar nature; nevertheless their true character is maintained and preserved unto the end. This cancer, as a rule, is of the soft or medullary form, and runs a very rapid course; an extreme example of melanotic cancer, indeed, presenting all the worst features of the other varieties. It has, however, peculiarities of its own, to which attention will be subsequently directed.

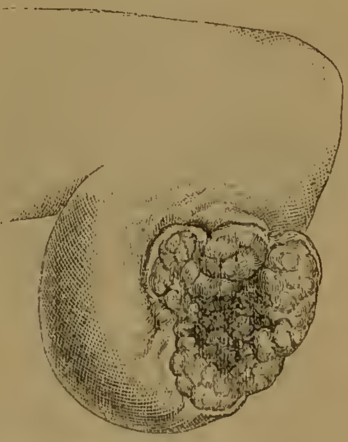
Osteoid cancer. The *osteoid cancers* will receive attention in the chapter devoted to the tumours of bone (Chapter XXXII). They are all probably only modifications of the medullary cancer affecting bone; although it may be mentioned that exceptional cases are on record where an osteoid cancer originated in some intermuscular interspaces.

Epithelial cancer. **Epithelioma** and epithelial cancer are terms given to a form of cutaneous cancer from its similarity in structure to the epithelial elements of the natural skin. In the chain of malignancy epithelial cancers are linked to the recurrent tumours, for they have both a tendency to return in a part after their removal, and to affect the system through the lymphatics; in exceptional instances they may be found in the internal organs.

Situation.

These tumours affect the skin or mucous membrane, and never originate in any other tissue; but they possess this feature in common with the more malignant cancers, that they have a constant tendency to infiltrate the parts with which they come in contact, and do not, as innocent tumours, simply separate them. They are the common forms of cancer found in the lip, tongue, œsophagus, rectum, scrotum, penis, clitoris, os uteri, vulva, &c.; they may be described as the cancer of the skin. In sweeps it is known as the "chimney sweep's cancer." Epithelial cancer is essentially an infiltrating disease; it is not, as the sebaceous, fatty, fibro-cellular or fibrous tumour, a distinct growth developed in the tissues and separating them, but is from its very beginning an *infiltration*. It begins, as a rule, in a wart or tubercle, and this grows; it may fungate, crack, fissure, or ulcerate, and when this latter stage has been arrived at, the careful examiner will at once observe its true character, for the integument forming its base and margin will be evidently infiltrated with the cancerous material, and will present the well-known raised, indurated, and everted edges (Fig. 18). These appearances form a marked contrast to the condition of integument which has been ulcerated or ruptured by over distension in an innocent growth.

Fig. 18.



Cancer of stump, of two years' standing, from a man, æt. 54.

May spread rapidly.

As a local disease, this epithelioma may slowly progress for years and cause little pain, inconvenience, or injurious influence; five, six, eight, or fifteen years have passed away in some of the cases before me ere advice was sought, and it may continue for many years before it affects a patient in other ways than by the local disease. On the other hand, when it once begins to spread, it may do so rapidly; when removed it may return at once, not only in the parts, but in the lymphatics of the district, and even in the internal organs. When it spreads locally, it may, as a cancer, infiltrate and invade every tissue as it touches it. I have seen it more than once originate in skin and end in the total destruction of a bone ('Guy's Hosp. Rep.,' 1875).

Epithelial cancer: its characters.

Epithelial cancer is made up of cells differing but little from those of ordinary epithelium, but they are grouped very differently, infiltrating the tissues in which they are placed or clustered together in masses, these masses being described as "nests," which are only found in this affection (Fig. 25).

The surface of an epithelial cancer may be dry and warty, or ulcerating; when ulcerating, it will be, like all cancerous sores, irregular, and discharge a thin or a creamy fluid. The edge will always be thick and elevated, like a wall of new tissue built up between the

May involve glands.

healthy and diseased structures; when the disease spreads it will invade and infiltrate every tissue, forming deep excavated sores. It may involve the lymphatic glands, as a cancer, and these glands may soften down, giving rise to a cancerous abscess or open sore, like other cancerous sores. It usually destroys life from local causes, and not from secondary infiltration of the viscera, it being exceptional for such a consequence to take place.

Treatment of epithelial cancer.

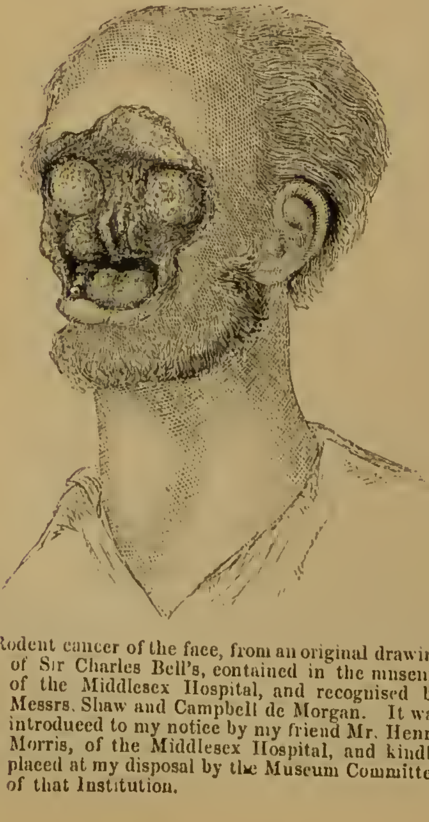
These cancers should always be removed, and the sooner this is done the better are the prospects of a cure or a long reprieve, for if any cancer has a local origin the epithelial has, and if it be removed before any glandular enlargement has taken place the prospects of a good result are great. Sibley ('Med.-Chir. Trans.,' vol. xlii) made out from the Middlesex Hospital records that epithelial cancers, on the average, destroyed life in fifty-three months, while scirrhous lasted but thirty-two. When removed by the knife care should be taken to cut well free of the disease, for it is not unusual in this, as in all cancers, to find the tissues around the tumour sparsely infiltrated with cancerous elements, which, if left, would cause a return of the tumour. The same advice is applicable when caustics are employed.

Removal by knife.

Removal by cautery.

In many examples of this form of cancer the removal by the galvanic cautery is by far the best method of treatment we possess, either as a cautery applied to the surface, or as a wire écraseur applied around the base.

Fig. 19.



Rodent cancer of the face, from an original drawing of Sir Charles Bell's, contained in the museum of the Middlesex Hospital, and recognised by Messrs. Shaw and Campbell de Morgan. It was introduced to my notice by my friend Mr. Henry Morris, of the Middlesex Hospital, and kindly placed at my disposal by the Museum Committee of that Institution.

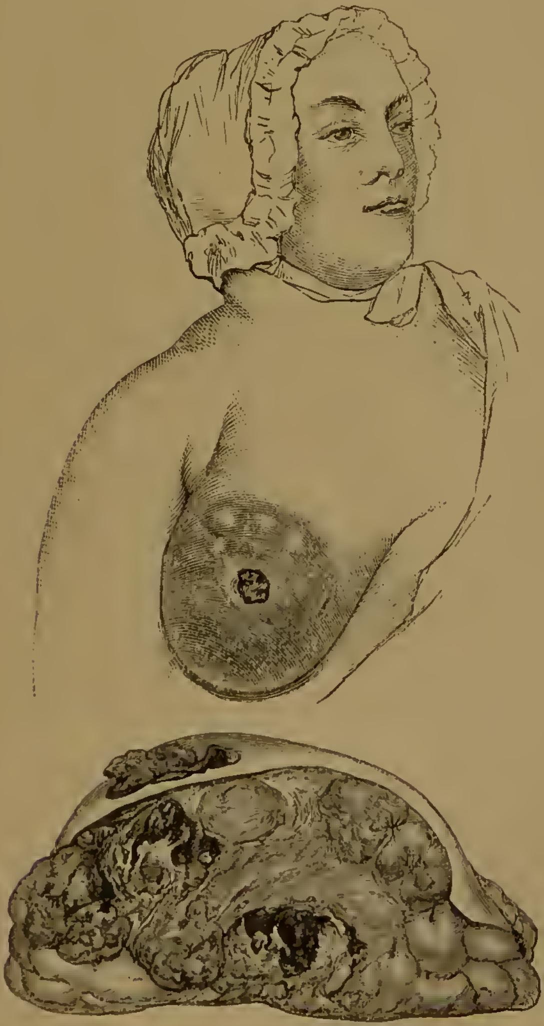
On rodent ulcers.

Characters.

Rodent Ulcers are closely allied to the cancers, and are more like the epithelial ulcer than the true carcinomatous form; Dr. J. C. Warren, of Boston, U.S., in an able essay upon this disease, asserts that the cells of the rodent ulcer differ from those found in the epithelial by being smaller. They are local cancerous affections, and expend their force in destroying every tissue they attack, but they do not spread by means of the lymphatics or by secondary growths. They usually begin as a dry wart on some part of the face, head, or other locality, and after this wart has shed many skins it begins to ulcerate. The ulcer spreads slowly and regularly; it has a border of new tissue, raised as a wall, to separate it from the healthy parts; outside the border the parts are soft and natural, inside they are generally smooth, as an indolent sore, devoid of granulations, and glazed (Fig. 19). There is little discharge from these sores when superficial, but when they are extensive, and have dipped down deeply into other tissues, this is not the case; when they inflame, also, they discharge a fetid ichorous pus. They seem to attack healthy as well as feeble subjects, and have little effect upon the general health until they touch vital parts. They appear after middle age. They are to be treated locally, by their destruction—cautery, escharotics, or scalpel being used, as seems most applicable. In local sores, when the knife can be used, it is probably the best instrument;

Treatment of rodent ulcers.

FIG. 20.



Case of colloid tumour of the breast, discharging externally, in a woman, æt. 65, with section of the same.

in others the galvanic cautery is unrivalled. In lieu of this the actual cautery may be used, and next to this escharotics; "the caustic burns through the entire depth of the solid disease, and upon the casting of the subsequent slough, cicatrization is rapidly completed."—*Moore.* The chloride of zinc, potassa fusa, Vienna paste, or acid nitrate of mercury may be used. The zinc rubbed down in a warm mortar with equal parts of fresh plaster of Paris is probably the best; it destroys and dries the tissues.

Colloid cancer.

Colloid cancer is hardly recognised as a special disease, for the term colloid is applied to tumours made up of intercellular spaces of variable sizes, filled with a clear glairy fluid, like glue, that contains abundance of granules and large nucleated cells (Fig. 25). The clinical history of some of these growths is that of an innocent tumour, whilst in others it is that of a cancerous one. Colloid tumours are found in the breast, parotid region, ovary, rectum, and intestinal canal. In this last region they are known as the alveolar or gelatiniform cancer. Their true nature is not yet fully understood.

In the case from which Fig. 20 was taken the patient was 65 years of age, and the disease had been growing for two years. The tumour occupied the outer portion of the gland, and had burst the skin covering it in. Through the opening the colloid growth projected, but the margins of the opening were not infiltrated with disease. There were no enlarged axillary glands.

Villous growths.

Villous growths may be cancerous as well as benign. When made up of cell-elements their cancerous nature is to be suspected, but the fact is only to be made out by the clinical career. Mr. Sibley, in the 'Med.-Chir. Trans.,' vol. xxxix, and 'Path. Trans.,' vols. vii, viii, and ix, has very ably discussed the nature of villous and colloid disease.

On causes of cancer.

The causes of cancer.

Local injury.

These are most obscure. *Local injury* at times appears to have a very marked influence in determining the seat of a cancer, but only in exceptional cases; one of these occurred to me recently in the person of a boy, æt. 18, who after an injury to his right spermatic cord in a few weeks became the subject of a pelvic tumour, which rapidly grew and eventually destroyed life by obstructing the rectum as well as the ureters. After death the tumour was found to have been cancerous, and it appeared to have originated in the right or injured cord, and to have spread downwards along the vas deferens to the base of the bladder, subsequently ascending from the pelvis above the level of the umbilicus.

Hereditary influence.

Hereditary influence has always been looked upon as a very decided cause, but in how small a proportion of cases of cancer can any such be found? Sir J. Paget traced it in one out of every three cases; Mr. Sibley in one of every nine; and out of 222 cases of my own it was traceable only in one of every ten instances. In many other affections, even the most innocent, as large a proportion might be found. In fatty tumours and in deformities all Surgeons recognise the frequency of an hereditary history. Indeed, looking at cancer as one of many diseases, there is no reason to regard it as being more hereditary than any other, and I am inclined to agree with Mr. De Morgan when he said "that all that could be said with regard to the constitutional nature of cancer applied equally to the constitutional nature of any, the smallest, growth that can be found in the body."

Striking examples of the hereditary nature of cancer are met with in practice, but they are not more, if so, striking than the hereditariness of growths of a simple kind. Sir J. Paget has pointed out, however, that when a local disease or deformity is inherited it passes from progenitor to offspring in the same tissue, if not in the same place. Whereas, when a cancer is hereditary, it may break out anywhere. "The cancer of the breast in the parent is marked as cancer of the lip in the offspring. The cancer of the cheek in the parent becomes cancer of the bone in the child. There is in these cases absolutely no relation at all of place or texture."

A disease of adult life.

Cancer is a disease of adult life, although it may attack a fœtus in utero, or an infant soon after birth ('Guy's Hosp. Rep.,' 1875), and when it does so, or affects an organ in the full vigour of its functional activity, it partakes of that activity and runs its course with marvellous rapidity. In a general way, however, cancer is most prone to attack an organ that has passed through the active period of its existence and is degenerating, as the breast or uterus. Sir J. Paget describes it as being "essentially a disease of degeneracy, and asserts that it increases in frequency in proportion to the number of persons living as age goes on."

Origin local.

Cancer appears to be in its origin a local disease, and to become general by either the influence of the juices of the primary tumour exercising an impregnative spermatic influence (Simon) upon other parts, or by dissemination of its elements—dissemination at first radiating from its local source and at a later period becoming general through the fluids of the body, the secondary growths partaking largely of the characters of the primary—the osteoid cancer propagating osteoid, and the melanotic melanosis, each cancerous growth, like a parasite, growing at the expense of the tissue in which it lies. Moore, in his work on 'The Antecedents of Cancer,' and De Morgan more recently have, I think, established this fact. From a clinical point of view, this is, without doubt, of very practical significance, for Surgeons now admit that the earlier a cancerous tumour is removed the better are the prospects of a cure or of a long immunity from the disease.

Treatment of cancer.

Treatment of cancer.

The *general treatment* of cancer resolves itself into the improvement of the general health, and the nutrition of the body by hygienic means, good nutritious diet, and tonic medicines. No medicine has any special influence on the disease.

Local measures.

The *local treatment* may be summed up in the word removal, for all cancers should, if practicable, be taken away as soon as formed, that is, as soon as their true nature has been established. In the early stage of a cancerous tumour, before the diagnosis has been made out, it should be protected from external injury, and from all irritating causes. No rough manipulation should be allowed, nor any movement of the muscles that surround or influence it. Warm or hot applications should be avoided, for there seems reason to believe they encourage its growth. The acutest cancer of the breast I ever saw was one that originated as a chronic infiltration, and was made active by the application of ot fig poultices for a week; the gland itself and skin over it to the imit of the application became infiltrated to an extreme degree with

Avoid hot applications.

cancer, which rapidly broke down, and destroyed life. The best protective application is cotton wool.

Iodide of lead and opium.

Belladonna.

Moore used to think highly of the local application of the iodide of lead and opium ointment, applied on lint to the tumour; he believed it had some influence in diminishing and retarding its growth. Some Surgeons have faith in iodine as a local application; I must confess that I have never been able to make out that any of these or other applications had the slightest influence in checking the progress of a cancer and have discarded them. When pain is present the belladonna extract rubbed down with glycerine into a fluid the consistence of treacle, or of the extract of opium similarly diluted, seems to be a valuable application; and an opium or belladonna plaster spread on leather gives comfort and protects the part.

Excision.

When the diagnosis is established the tumour should be removed, and the best method is, doubtless, that by excision; delay being only justifiable when the general condition of the patient forbids the attempt. To delay is only to increase the risk of a local dissemination of the cancerous elements, and thus diminish the prospects of a successful result; to give time for the lymphatic glands to become enlarged, when removal of the primary growth becomes of less value; and to increase the chance of some internal or remote organs becoming involved, when all operative interference must be futile.

Free removal.

In removing a cancerous tumour the Surgeon should not be too sparing of surrounding tissue; when it is encapsuled there is no necessity for doing more than enucleating the mass, but when it infiltrates an organ the only correct treatment is the removal of that organ, and in removing the organ care should be observed to take away all skin that is in any way adherent to its surface, and as much of the surrounding fat as circumstances will allow.

Avoid leaving tubercles behind.

Glands to be removed.

When the tumour has been removed all surrounding parts should be carefully examined, for it is not uncommon to find small cancerous tubercles in the connective tissue, fascia, or muscular sheaths, that if passed by unheeded would soon increase and give rise to a recurrent growth. Indeed, it is from these points that such recurrent growths probably often arise, and these the Surgeon, by care and observation, may often prevent. De Morgan, after excision of a cancerous tumour, washes the wound with a solution of chloride of zinc, twenty grains to an ounce, to destroy the cancer germs. The Surgeon had better remove all skin and allow the wound to granulate up, than save integument which is of doubtful integrity for the sake of making an apparently more complete operation. When lymphatic glands are enlarged and can be removed at the time of operation, they should not be forgotten; they should be enucleated by the fingers or handle of the scalpel rather than be excised, their capsules should be divided and the glands turned out.

Cancerous tumours of the tongue, penis, clitoris, labium, neck of the uterus, &c., may be removed by the wire or chain écraseur, either with or without the cautery, but this subject will receive attention in other pages.

Removed by caustics.

When a cancerous tumour cannot be excised or the cutting operation is rejected, it may be removed by caustics; but this method is more painful, slower, and not more successful than excision. When employed as a substitute for it, it is, like all substitutes, only second best; it is, however, applicable where excision is not. The French Surgeons do this by inserting around and into the tumour thin conical flat wedges of chloride of zinc made into a hard mass with flour or plaster of Paris, holes being made into the tissue for the introduction of these flèches by the scalpel. Maisonneuve is the chief practitioner of this school.

Caustic arrows.

The "caustic arrows" of M. Maisonneuve are composed of wedge-shaped pieces cut from a thin cake of paste made by mixing one part of the chloride of zinc and three parts of flour with as much water as may be found necessary. These pieces or arrows are dried, and they may be kept in a bottle for a long time without injury.

Strong acids and caustic paste.

In England this plan finds little favour; the following method is more general:—In a tumour that is not ulcerated let the skin be destroyed by the application of some strong sulphuric or nitric acid, and in this slough let one or more incisions be made; into this let a paste of chloride of zinc and flour mixed with the extracts of the Sanguinaria Canadensis, and stramonium, be introduced, fresh incisions being made through the thickness of the slough thus formed every other day, and fresh paste inserted; in this way the whole tumour may be destroyed or enucleated. The paste is a modification of that introduced into London by Dr. Fell, of the United States, and is, without doubt, the best working caustic paste we possess. The following is the way to make it:

Fell's paste.

Boil down to a liquid extract some decoction of the Sanguinaria Canadensis, and with an ounce of the extract dissolve an ounce of the chloride of zinc. Mix this with two ounces of the extract of stramonium, and a soft paste is ready for use.

Canquoin's paste.

Canquoin's paste is composed of chloride of zinc and flour in equal parts, a few drops of water being used to make it into a paste. A second form is probably better than this:—Chloride of zinc one part, muriate of antimony one part, flour one part and a half, water a few drops. This paste is of the consistence of soft wax. At the Middlesex Hospital they use a paste made by mixing chloride of zinc and boiled starch with laudanum till it reaches the consistence of honey.

When the tumour is ulcerating or open, there is no necessity for the primary application of a liquid caustic. The paste may be applied directly to the part, and fastened on by cotton wool and strapping; a thickness of half an inch applied for twelve hours usually produces a slough an inch deep.

Other caustic applications.

Some Surgeons prefer a solution of chloride of zinc alone inserted on cotton wool. M. Rivallié uses nitric acid applied on lint or asbestos; Velpeau, sulphuric acid on saffron. In some cases the Vienna paste is preferred. Arsenic as a caustic has had its day; it is dangerous and less effective than zinc.

Chloride of zinc paste in epithelial cancer.

For cutaneous epithelial cancer the caustic treatment is the best. The chloride of zinc made into a paste with flour, or with sanguinaria, may be used according to fancy. The potassa fusa is likewise a useful form. When the galvanic cautery can be obtained epithelial skin cancer may be readily destroyed. I have burnt down many affecting the nose, cheek, eyelid, scalp, hand, arm, lip, and other parts; by it a large surface of diseased tissue may be completely carbonised and a healthy surface produced after the removal of the eschar. The operation should be performed with the aid of chloroform, and the whole thickness and edges of the diseased tissue destroyed. The after-pain is very slight, the cautery destroying all nerve sensibility. It is by far the best mode we possess of dealing with skin cancer, more rapid in its action and certain in its result, besides being far less painful than any other. When the disease extends it may be removed with the scalpel and the base of the sore cauterized. No more efficient mode of removing a skin cancer than this is within our reach.

On treatment of tumours by injection.

The treatment of tumours by injection of fluids into their substance, as originally suggested by Sir J. Simpson, and more recently practised by Dr. Broadbent, has in it the elements of a successful plan, but has not yet been brought to any available state of perfection. Fatty tumours may be destroyed by the introduction into their substance of a few drops of deliquescent chloride of zinc, but cancerous tumours do not appear amenable to a like plan. Dr. Broadbent believes that he has succeeded by injecting a liquid composed of one part of acetic acid and three parts of water; and Messrs. Moore and De Morgan assert that they have each succeeded in obtaining gradual diminution of cancerous growths by these means. I tried the plan in twenty cases, when it was first introduced, but never found any good result ensue from it; it was often very painful, and many patients refused to have it repeated, although they asked for the excision of the growth. More recently the injection of twenty drops of a solution of bromine dissolved in spirit, ♏v to a ʒj, has had its advocates.

Treatment by pressure.

The treatment by pressure is of no practical value.

By way of summary, it may be stated that cancerous tumours should be excised when practicable, and the sooner the operation is performed, after the diagnosis is clear, the better. That removal by the écraseur is equivalent to excision.

Treatment of open cancer.

That open cancerous tumours had better, as a rule, be treated by caustics, or by enucleation; the best caustics being those which contain chloride of zinc.

Of skin cancers.

That for skin cancers caustics are, as a rule, the most available, although excision in some instances, as in the lip, is to be preferred; that the galvanic cautery, however, should be employed when possible, it being the most rapid and efficient destructive agent we possess.

ON THE MICROSCOPICAL ANATOMY OF TUMOURS.[1]

General observations.

Two distinct processes are observed in the construction of our bodies; the production of the elementary pieces, by whose compilation the fabric is composed; and the disposition of these elementary pieces into certain forms and shapes suited to the requirements of the part to be made. These two processes differ as much as making bricks differs from building; we may call them construction in the first degree and construction in the second degree. Each of the several kinds of flesh of which the body is composed has constructive elements peculiar to itself, and these elements are disposed in each tissue in a manner proper to that tissue. I need not instance examples, the fact is so familiarly true throughout physiological histology.

In the composition of the normal tissues the elements are fitted in form, size, and other characters for their proper use, and they are united together to compose structures which are adapted to their peculiar functions. We have no knowledge of the influences which induce the perfect adaptation we thus observe; but we can appreciate its necessity, since, without such fitness of the parts for their several duties, organization and organized life would not exist.

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[1] This section of the chapter, in its entirety, has been written by my friend and colleague, Dr. Moxon.

Now when *morbid* growths arise in the body, do they show any constructive adaptation parallel to that observed in normal tissues? Is there any constancy in their elements, any weaving of these elements into structures? It is only of late years that any attempt has been made to answer this very interesting question by careful study and comparison of the minute anatomy of morbid growths. It has been found that the nature of the elements of those growths, and still more the kind of texture they compose, serve usefully to indicate the tendencies and consequent dangers which constitute their clinical importance as tumours.

They were formerly aware that in the healing of wounds the new materials are made in the likeness of the parts which they adjoin, and whose function they supplement and in due time discharge. But this transformation of newly produced matter to the nature of the tissue adjoining was regarded, so far as it was regarded at all, as in some way the effect of the neighbouring part. The production of new elements and their employment in construction of organized forms were not traced out as distinct histological processes; nor regarded as showing an active vital power in the new substance itself. Do we not need to distinguish these processes more plainly even now in our own time?

When the microscope was employed upon tumours as a means of discovery, observers at first looked only to construction in the first degree which coarse microscopical examination could easily discover; and for a long while it was, and with some still is, the only question, what is the character of the component cells of the tumour. As if in the study of buildings, one considered only what sort of bricks or stones they are made of. True, this would serve to divide them into brick, stone, concrete, and mud buildings, and we must not despise such an advance, which is a real step forward, in comparison with entire ignorance of structural composition.

But now we no longer confine attention to the component cells of tumours; rather in the study of them we have a main regard to the mode in which they are put together, and the degree and kind of organization which is undergone in the raising of them into often truly complex fabrics, such as we find many tumours to be when we properly comprehend their organization.

Construction of tumours.

It will naturally be asked, do the pathological tumours evidence any new plan of building, or are they always on the plan of some natural type; is there anything new in the nature, or, if I may so speak, in the conception, of any pathological tumour? The answer which has the greatest authority, that of the illustrious Virchow, on its side, is that there is nothing new in the plans of construction of tumours, but that all tumours are formed of substances natural to the body.

It has long been well known that a large proportion of tumours, especially those which show the most innocent disposition, have a structure like that of some healthy tissue. And this induced the naming of tumours after the tissue that they resemble, *fatty*, *fibrous*, *bony*, &c., or, as they are called, Lipoma, Fibroma, Osteoma (the termination -oma is now universally chosen to express tumour with structural resemblance to the tissue called by its prefix). Virchow's doctrine of the constant homology of every new tissue with some tissue natural to the body has induced him to carry this classification of tumours further than it was hitherto taken (unfortunately his book remains incomplete, and in some of the greatest difficulties the subject remains wanting his help). As a method of arranging tumours it is convenient, whatever may be said about his opinion that no new substance can arise in the body. I believe that this opinion should be taken along with due consideration if we would have a true view of the matter. Granting that whatever arises in the human body must be a human accident, so that feathers or cherry-stones will not develope in it, yet we must also see that the expression of all human accidents is not completed in the healthy man, but rather by elaboration and variation out of him into something else different, though still human. Positively all intermediates between his healthy tissues might be expected, and indeed many intermediates do arise which sufficiently show how wide a scope this possibility allows.

Indeed, it should be forcibly said that while those assumedly natural tissues found in tumours are really like the natural tissues of the healthy body in general description, yet they in all or almost all instances will be found to show differences in the building up of the elements, or even in the elements themselves, which make the common identification of them with the tissues they resemble rank only as a convenience, not expressing the whole truth of the matter.

Indeed, this proposition I would lay down with confidence, that no morbid growth is ever found which has not in it sufficient peculiarity to distinguish it from all natural tissues, which peculiarity is to be looked at by those who would explain its characters and history; so that they should not exclusively regard those features it has in common with natural tissues. The practically important side of the matter is that osteoma is not bone, and enchondroma is not cartilage, and lipoma is scarcely fat. Nevertheless it is very convenient to be able to classify tumours by their structural *likeness* to the natural tissues developed or in course of development. Yet it is only in this sense as *like, but not identical,* that the grouping of tumours to correspond with the grouping of natural tissues is here practised.

Malignancy. **Malignant; Cancer.**—The question must be dealt with, what is the relation of the common clinical division of tumours into cancers, recurrent and simple tumours, or into malignant, semi-malignant and benignant tumours, to the histological structure of the tumours? We will shortly consider these divisions. Simple or benignant tumours are those that have no malignancy, and recurrent or semi-malignant tumours are those which have only a partial malignancy, so that the only *positive* question is what characters make a tumour malignant, or constitute it a cancer.

Malignant.—In a very common yet vague sense the term malignant is applied to any fatal tumour, superficial or internal. There is no defence for this except from colloquial convenience. These fatal tumours certainly are not easily viewed as benignant or innocent. And hence arises this common use of the word malignant, making innocency positive, and regarding all that are not innocent as deserving by negation the opposite term. But as I have said, malignancy is the active and positive thing to which innocency stands as a negative.

General characters of malignant growths.

What are the active and positive characters and behaviour of a tumour that get it the name malignant?

A tumour obtains the name with different authorities from two rather distinct points of view.

First. Paget, for instance, has regard to the *descriptive peculiarities* of the more destructive kind of tumours, and hence describes malignant tumours as follows:

"1. The intimate structure of malignant tumours is, usually, not like that of any of the fully developed natural parts of the body, nor like that which is formed in a natural process of repair or degeneration.

"2. Malignant growths may have the character of infiltrations; *i. e.* their elementary structures may be inserted, infiltrated, or diffused in the interspaces and cavities of the tissues in which they lie.

"3. It is, also, generally characteristic of malignant tumours that they have a peculiar tendency to ulcerate, their ulceration being preceded by softening.

"4. The softening that often precedes the ulceration of malignant growths can hardly be considered separately from the minute account of their structure. I therefore pass it by, and proceed to their fourth distinctive character, which is to be noticed in the modes of their ulceration.

"5. Malignant tumours are, again, characterised by this: that they not only enlarge, but apparently multiply or propagate themselves, so that, after one has existed for some time, or has been extirpated, others like it grow, either in widening circles round its seat or in parts more remote.

"6. A sixth distinctive character of malignant tumours is that, in their multiplication, as well as in their progress of ulceration, there is scarcely a tissue or an organ which they may not invade."

Second. Another class of pathologists regard rather the *properties of* the tumours which have been discovered as giving rise to those clinical peculiarities which Paget so well describes; and hence say that a malignant tumour is one (1) which infects the neighbourhood, so as to show its offsprung elements in the tissue around, so that it (2) recurs after removal, because its seed was left; and (3) also extends to the lymph-glands along the lymph stream, and (4) to the great vascular viscera, or to points in the whole blood-carrying system, by infection of the blood stream. In short, these pathologists reduce the word malignant into a compass which would be exactly expressed by such a bad compound word as auto-infections.

Now, the compass of these two several lines of application of the word malignant is much the same. One describes what the other explains; the other explains what the first describes. If we are to decide which is the better, it must be settled by observing whether description or explanation most usefully determines the kind of a tumour. I think description must be widely and laboriously detailed to compass the expression of the signs of malignancy, and that the learner will scarcely carry descriptions which could fortify him against mistake. On the other hand, the conception of malignancy as auto-infectiousness is at once grasped, and, if discreetly used, will generally serve to give a sufficient clue to the nature of any given tumour.

Thus, as to any tumour of the breast, the inquiry, on one system, will be—"Does it push parts aside, or grow into them?" On the other—"Is the skin, &c., stretched over or involved in the tumour?" These questions, you see, amount to the same thing.

Again, on the one system the question will be—"Does the disease infect all through to the surface, and then open on it?" On the other—"Is the skin simply stretched, perhaps burst through, and does the tumour simply thrust out itself, while healthy skin awaits its chance to heal? Or is the edge of the opening thick and everted, and callous with such and such an ulceration?" This, again, is the same question. But, repeating, as the student can, such ways of considering the characters of innocency, he will, I believe, soon learn to value the short comprehensive and comprehended grasp of them by the consequences of their auto-infectiousness, by means of which he can infer or explain the more tedious descriptive terms.

Cancer.

Cancer.—The word *cancer* is best regarded as the substantive which is equivalent to the adjective malignant, so that a tumour that is malignant is a cancer, and a cancer is a malignant tumour. If we accept this, there is no longer any need of discussing the compass of the word cancer; and, indeed, now and always, this has been the most ready and natural use of the word, and the one most universally employed. For if you watch the writing or speaking of any one who, priding himself on descriptive accuracy, limits the term cancer to carcinoma (p. 139), you will invariably find that before long he is using the word cancer as the equivalent of malignant.

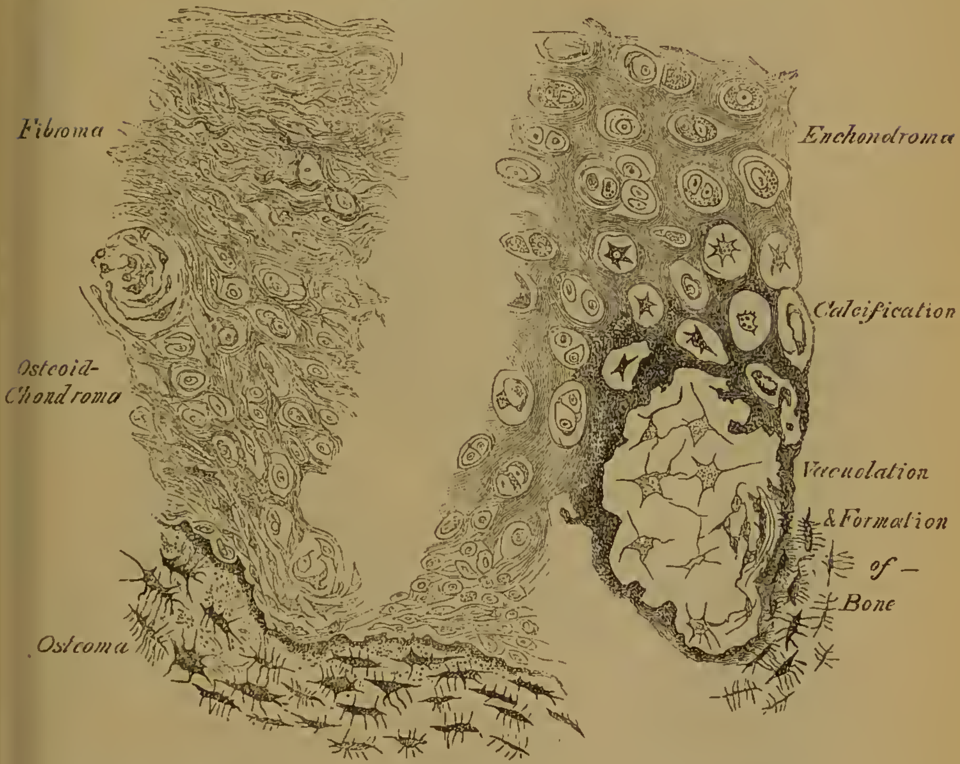
On the other hand, the word cancer is made by some to be the equivalent of carcinoma; the latter having a limited application to a certain kind of tumour structure (see Fig. 25). Surely this is superfluous. The word carcinoma is enough for its proper application, and in pathological questions of precision there is no hurry or vagueness to prevent the employment of four syllables. So I think the word cancer may be left to its colloquial wide signification as a malignant tumour of any sort, carcinomatous or otherwise. Certainly, tumours of various histological structure do prove auto-infectious or malignant. The tumours which most frequently show this malignancy are in order—(1) Carcinoma in all its forms, (2) Sarcoma, (3) Myxoma, (4) Lymphoma. Other structures, also, are far from being free of the risk of auto-infection.

Recurrent growths.

Recurrent or semi-malignant.—Auto-infection is, in some kinds of tumours, rare or incomplete in its manifestation. Thus, some spindle-cell sarcomas will recur often after removal, and yet show little tendency to invade the internal parts. Then, again, squamo-epithelial cancer extends to the glands, but not generally to the viscera. Also, soft, quickly growing sarcomata will extend fiercely to the viscera, and not invade the glands at all. In other words, auto-infection, in its three kinds, viz. infection of site, of gland, and of viscera, is not seen equally in all the sorts of infectious tumours. This is significant, and needs working out. It is convenient to call imperfectly malignant tumours semi-malignant. Sir J. Paget proposed the term recurrent fibroid for spindle-cell sarcoma, and its use was at one time general, but is now giving way to the more systematic term. Some classification of the partially infectious tumours by their kinds of infectiousness may be agreed upon, but as yet the time has not come for it.

OSTEOMA, OSTEOID CHONDROMA, ENCHONDROMA.

FIG. 21.



When bone forms a large part or apparently the whole of a tumour, the tumour is called an osteoma; but no tumour is ever formed altogether of bone, there is always present an ossifying matrix by the ossification of which the bony part of the growth enlarges. The kind of matrix varies much; thus, sarcomata or even carcinomata may directly ossify, and so we get *osteo-sarcoma* and *osteo-carcinoma*; but the forms of matrix which produce growths of practically a bony nature are generally two, viz. periosteum and cartilage. Periosteum, or to speak more exactly a tissue resembling closely the deeper layer of the periosteum, forms large tumours whose transformation into bone takes place in the manner shown in the left side of the above figure; the cells take the shape of bone-cells, and the matrix calcifies; these tumours are called *osteoid chondroma* or *periosteoma*.

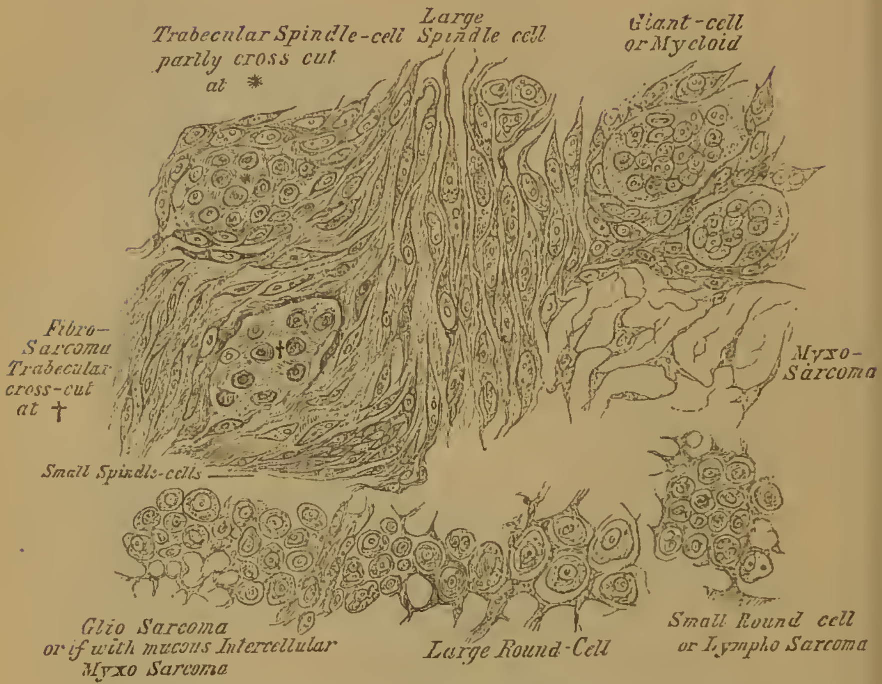
Cartilage often appears to be ossified when it is only petrified by deposit of calcareous salts in its matrix (see right side of Fig. 21); this change is, as is well known, the first step in ossification of cartilage. In many cartilage tumours the process goes no further, or it may proceed through the several stages shown in the right side of the figure, viz. vacuolation, formation of medulla-cells in the vacuoles, and direct transformation of these to bone-cells, as seen in the lower and right part of the drawing. More rarely the cartilage-cells, without calcifying, proliferate and change directly into bone, as seen in the middle of the figure.

The amount of cartilage, periosteum, or bone, present varies indefinitely in different cases. When cartilage preponderates the tumour is called an *enchondroma*; when bone preponderates, an *exostosis, osteoma*, &c., according to its shape and connexions; when periosteum preponderates, an *osteoid chondroma*, as before said.

Occasionally the amount of bone and cartilage is so equal that it is a matter of difficulty to decide which name shall be used; and then the terms *cartilaginous exostosis*, or *ossifying enchondroma*, are employed. *Osteoid chondroma* is to be suspected of malignancy; it makes a part of what were called *osteoid cancers*.

SARCOMA.

FIG. 22.


Trabecular Spindle-cell partly cross cut at *
Large Spindle cell
Giant-cell or Myeloid
Fibro-Sarcoma Trabecular cross-cut at †
Myxo-Sarcoma
Small Spindle-cells
Glio Sarcoma or if with mucous Intercellular Myxo Sarcoma
Large Round-Cell
Small Round cell or Lympho Sarcoma

The above schematic figure is composed of accurate drawings of portions of the several kinds of sarcoma named, but they are gathered together in a diagrammatic way, the forms being graduated into each other as they are when found side by side in the same tumour.

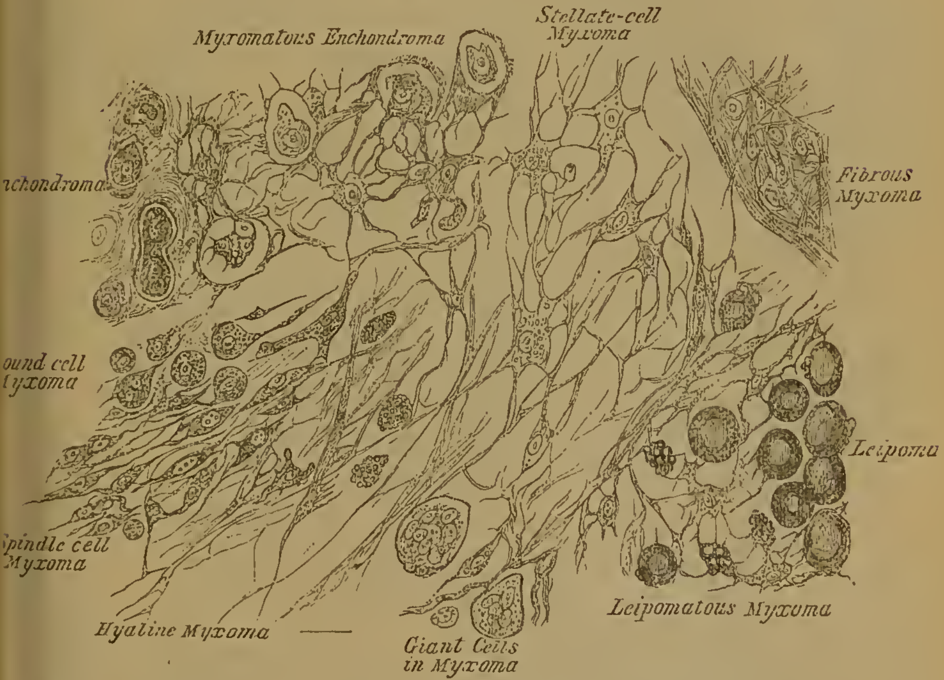
The distinctive histological character of *sarcoma* is the possession of a stroma between the cells, an atmosphere of intermediate matter which surrounds each and is between them all; the qualities of this intermediate or "intercellular" matter determine the kind of sarcoma.

The relation of sarcoma to the connective class of tissues appears to be this, that when one of these tissues is produced very rapidly it has no time for its intercellular matter to acquire the proper characters of it, so remains indeterminate, while it also is small in quantity, the cells greatly preponderating. Thus, any of the normal connective tissues may produce by rapid development a tumour of sarcous tissue or sarcoma (the name is well chosen, *σαρξ*, which equals *caro*, or our word *flesh*, means commonly any soft animal substance, not blood nor bone). Thus it follows that there are several kinds of sarcoma, according to the tissues of which they are a development. The principal of these are seen in the above schematic figure. The round-celled kinds generally arise from lymph-gland, or neuroglia, or mucous tissue; hence they are common in myxo- or glio- or lympho-sarcoma. The spindle-celled kinds arise from connective, fibrous, or bony tissue, and hence are most common in fibro-sarcoma or osteo-sarcoma.

MYXOMA.

The name myxoma is given to all tumours of connective-tissue type (not epithelial) which contain mucus or mucin in their intercellular matter. It corresponds nearly to gelatinous sarcoma, collonema, and fibro-cellular tumour of older authors; the forms of the cells are very variable, but in the most typical examples, and especially in the older and fully developed parts, the cells are large and usually multipolar or "stellate," with a distinct nucleus and nucleolus; the stellate branching rays of the cells are mutually connected, so as to form a more or less open network, in the interstices of which the mucous semi-fluid lodges. Beams and bands, which generally have a stiff rigid appearance and an angular rather than a wavy disposition, pass about, dividing up the substance of the tumour into very imperfectly defined sections, more or less visible to the naked eye; from these arise fine fibrils continuous with the cellulo-fibrillar network. Much of the tumour, and especially the younger part, may be found formed of spindle-cells; these are really connected, by threads from their sides, with the intermediate fibrillar network, and it can often be seen that the stellate forms are produced by the drawing out of these threads to greater lengths, by the separation of the texture-elements, by the increasing quantity of mucus. In yet other examples or parts the prevailing form of the cells is round, or with one pole; the round cells resemble ordinary mucous corpuscles, and are scattered among the fibrils in the mucoid matter; they often contain many fat-grains, and are found in the oldest parts of the tumour, representing the senescence of its cells. There is also a great variability of the intercellular substance, first, in proportion of the fibrous to the cellular part; and second, in the proportion which these solid elements bear to the mucoid interstitial matter; thus, there is a fibrous myxoma, and a clear pellucid variety, with much mucous fluid, perhaps even forming cysts (hyaline and cystic myxoma). In some examples there are large polynucleated cells, identical with the so-called giant-cells of "giant-cell" sarcoma.

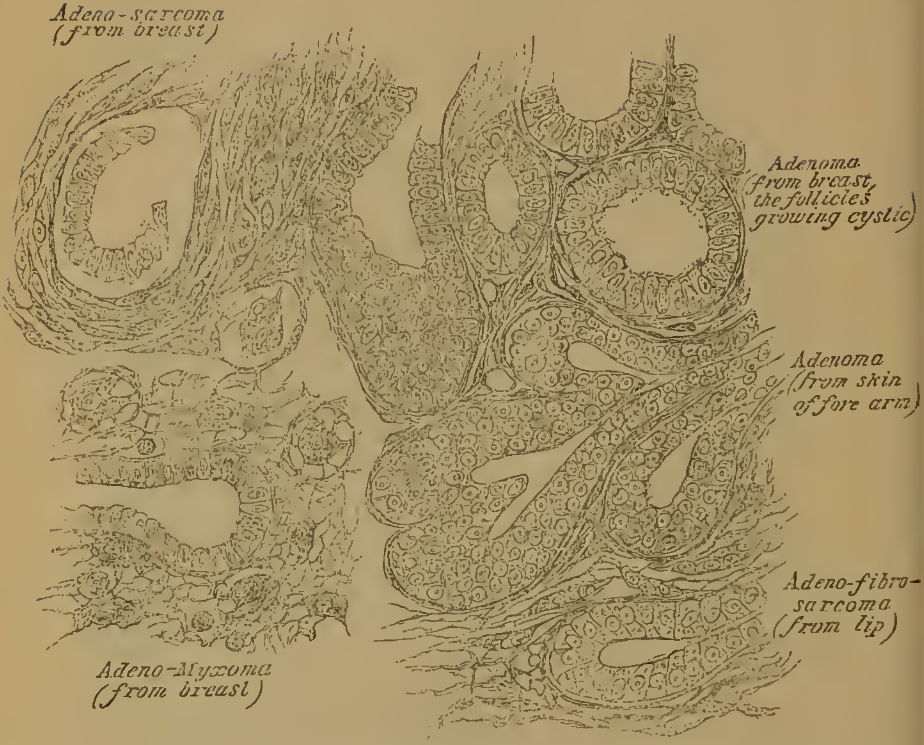
FIG. 23.



In the theory of types, myxoma is affiliated to certain natural tissues, in particular the jelly of the umbilical cord, the vitreous of the eye at a stage of its development, and the early stages of adipose tissue, as well as a stage of bone formation out of cartilage. It will be seen that these typical tissues are only transitory in their nature, as compared with such stable tissues as bone, cartilage, tendon. In accordance with this instability of their type, myxomas themselves show many transitions to many kinds of connective tissue; these transitions are chiefly towards cartilage or fat (myxomatous enchondroma, myxomatous lipoma). Tumours are not infrequent, especially in the parotid region, which are intermediate between cartilage and mucous tissue, so that one cannot say to which they most properly belong: also, many fatty tumours show clear gelatinous patches of mucous tissue in all transitions to fat, while many myxomata show opaque spots composed of true adipose tissue.

ADENOMA.

Fig. 24.

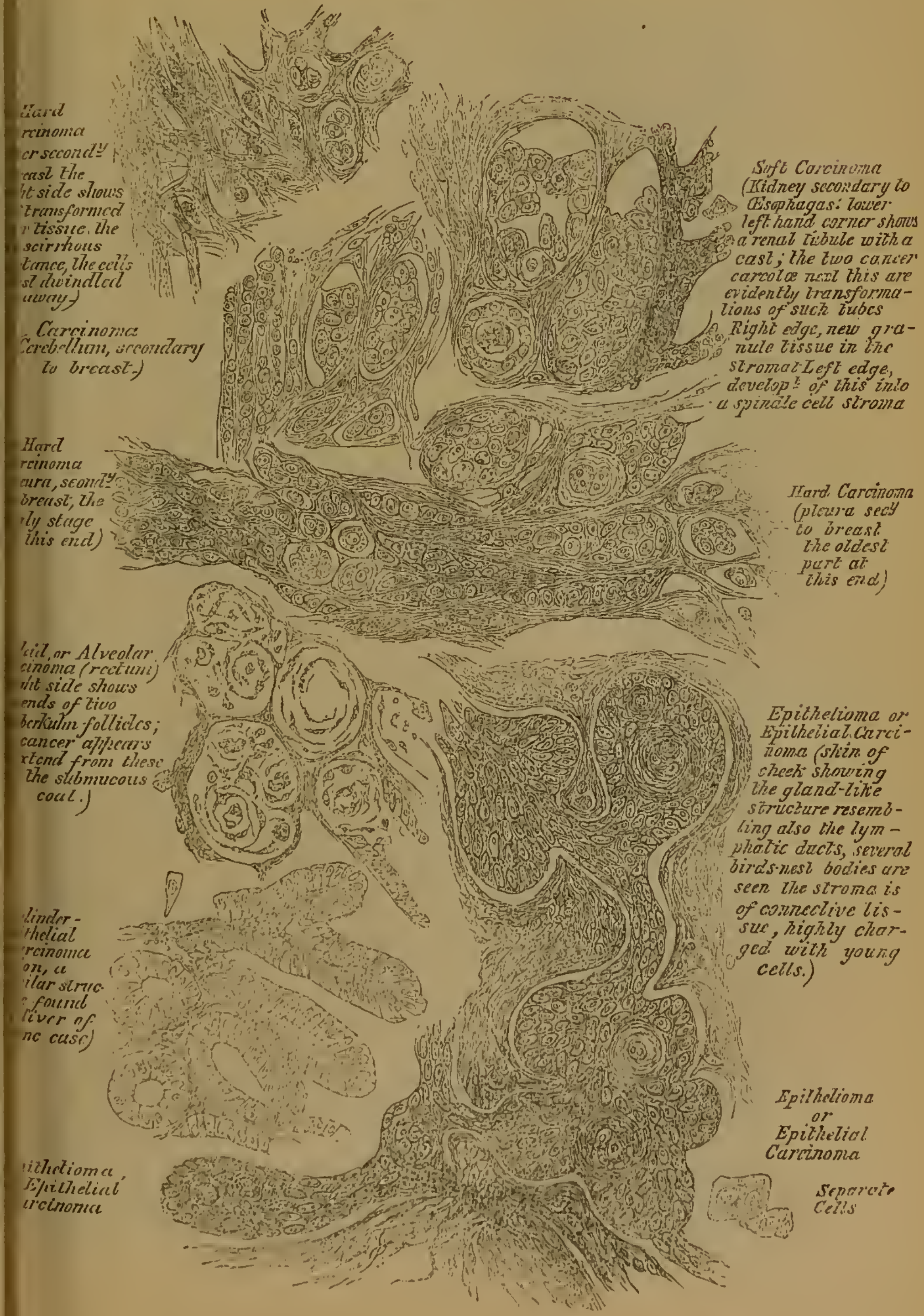

Adeno-sarcoma (from breast)
Adenoma (from breast, the follicles growing cystic)
Adenoma (from skin of fore arm)
Adeno-fibro-sarcoma (from lip)
Adeno-Myxoma (from breast)

The essential character of adenoma lies in the possession of a glandular structure; but the comparative amount of the glandular element varies much. There is also variety in the kind of tissue which is found between the gland-follicles. Some tumours show structure identical with that of compound racemose glands, more commonly the follicles are dilated more or less, so as to form cysts; one or more of these may prevail so as to give a cystic character to the whole (cystic adenoma). Besides the cysts arising in this way, others may be formed by a breaking down of the intermediate tissue, especially if it happen to be mucous tissue. More frequently the glandular elements are surrounded and separated by a new formation, which may be so much developed as to more or less entirely take away the glandular character of the growth; this interstitial tissue may either be fibrinous, sarcous, or mucous, or more rarely cartilaginous or areolar; or it may present characters combining these or mediate between them (*adeno-fibroma,—sarcoma,—myxoma*). When the proportion of gland is small, there is doubt whether it is not part of the original gland-tissue persisting in the new substance; thus, the relative augmentation of the cavities of ducts or follicles may make the tumour take the character of cyst, or the relative augmentation of the intermediate tissue may make it take the character of sarcoma, myxoma, or fibroma; but if the glandular substance is maintained in due proportion, the natural resemblance of adenoma is to carcinoma. These, however, show larger nuclei in their cells, and the nuclei have thick outlines and contain many nucleoli; the cells are of more varied forms, and make usually compact columns and bulbs rather than follicular cavities.

CARCINOMA.

The term carcinoma is now distinctly applied to such tumours as have a structure of the following description, viz.—A meshwork of fibrous or sarcous substance composing an alveolar structure, whose interstices are filled with cells. These may have no orderly

FIG. 25.


Hard
rcinoma
er secondᵞ
east the
ht side shows
transformed
r tissue, the
scirrhous
tance, the cells
st dwindled
away.)
Carcinoma
Cerebellum, secondary
to breast.)
Hard
rcinoma
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breast; the
ly stage
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lid, or Alveolar
cinoma (rectum)
ht side shows
ends of two
berkuhn follicles;
cancer appears
xtend from these
the submucous
coat.)
linder-
thelial
rcinoma
on, a
ilar struc-
found
liver of
ne case)
ithelioma,
Epithelial
rcinoma
Soft Carcinoma
(Kidney secondary to
Œsophagas: lower
left hand corner shows
a renal tubule with a
cast; the two cancer
carcolæ next this are
evidently transforma-
tions of such tubes
Right edge, new gra-
nule tissue in the
stroma. Left edge,
developᵗ of this into
a spindle cell stroma
Hard Carcinoma
(pleura secᵞ
to breast
the oldest
part at
this end)
Epithelioma or
Epithelial Carci-
noma (skin of
cheek showing
the gland-like
structure resemb-
ling also the lym-
phatic ducts, several
birds-nest bodies are
seen the stroma is
of connective tis-
sue, highly char-
ged with young
cells.)
Epithelioma
or
Epithelial
Carcinoma
Separate
Cells

or methodical-looking arrangement, being packed in the crevices in the meshwork (or alveoli, as they are called), and extending casually from alveolus to alveolus, so as to make a complementary meshwork. The carcinomatous character is determined by the presence of such alveolar structure, with cell-collections lodged in it; the decisive point consists in these cells lying close together without any intercellular substance; the cells generally vary in shape, and have large nuclei, with large and bright nucleoli. But often the cells have an arrangement very like the epithelial lining of the follicles of the secreting glands, a structure which may be so well pronounced as to bring them almost into continuity with adenomas; they differ from these chiefly in their history as being infectious, so as to extend into the neighbouring tissues, to the glands, or to the viscera, the structure showing, perhaps, only this peculiarity, that the stroma of carcinoma is charged with cells.

Five leading types of carcinoma may at present be conveniently distinguished.

1st. Those in which the fibrous meshwork is in preponderance, and the epithelioid contents of the alveoli are scanty, and, perhaps, also prone to perish early, so that they are found more or less degenerate within the fibrous meshes—Hard Carcinoma, or Scirrhus.

2nd. Those in which the fibrous meshwork is in smaller proportion, and the epithelioid contents are plentiful, making large collections of cells, but with no evident approach in the form of these collections to the shapes of gland-acini, and no evident resemblance of the component cells, either to the columnar epithelium of mucous glands, or the squamous epithelium of cuticle—Soft Carcinoma. This kind occurs especially in glands, and the transformation of the glandular tubes or follicles to cancer alveoli can be seen in all stages in the growing margin of the tumour (see the upper two drawings in the figure, from the liver and kidney).

3rd. A structure essentially such as that last described, but with this difference, that the epithelioid cells have a quantity of mucus between them, which is regarded as arising from a transformation of them. This change to mucus may be carried to such an extreme that scarcely any cellular elements are left, while the alveolar meshes in which the mucus is contained becomes very strikingly visible from its nakedness and the pellucidity of the mucus—Colloid, or Alveolar Cancer. A common seat of this is the wall of the alimentary canal, where it may be traced arising from Lieberkühn's follicles.

4th. A structure in which the epithelial cells resemble squamous epithelium, and form masses which are very like the follicles of cutaneous glands, or occasionally like rudimentary hairs; the tubular and bulbous forms may, however, be seen ramifying like the lymphatic vessels of the skin, as if their form were moulded to the lymphatic plexus. In these cancers peculiar bodies are found, composed of flattened cells disposed concentrically so as to form a scaly-walled globe, whose appearance is like the section of an onion, or like a bird's nest; these are so large as often to be visible to the naked eye; when they are numerous and well characterised, they are diagnostic; some authors (Billroth) distinguish a variety of this cancer in which the stroma preponderates over the epithelial part, calling it scirrhus of the skin—Squamous Epithelial Carcinoma.

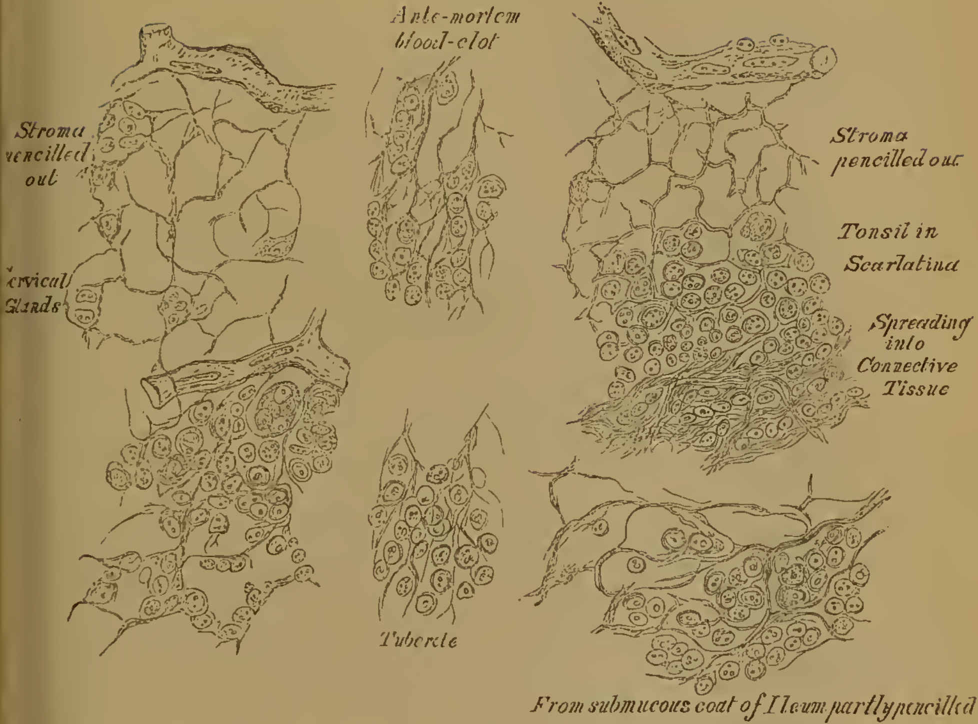
5th. A structure in which the epithelial cells resemble ordinary columnar epithelium, and the structure itself is quite like normal mucous membrane, in which it always primarily arises (alimentary canal, especially colon, uterus); the secondary formations which occasionally occur in these cases, in the liver especially, have the same structure, and thus a tissue like the glandular mucous membrane of the colon may be found in the liver—Cylindrical Epithelial Carcinoma.

The fourth and fifth varieties are distinguished from the three first as epithelial cancers or epitheliomata. Some authors have used the term cancroid for the fourth variety, as though it were not completely cancerous. These are less likely to infect the viscera than the first two varieties, which are the most infectious of all tumours, though they are very far from being the only kinds of infectious tumours.

LYMPHOMA.

The name lymphoma is given to such growths as have a microscopic structure like that of lymphatic glands; in particular, which have a finely reticular meshwork, connected with which are some fixed cells at tolerably regular intervals, not unlike the fixed cells of connective tissue, but generally larger. Within the meshes of this network are numerous cells, which resemble lymph-cells, and hence are also like pus-cells and white blood-cells. The proportion of network to the contained lymphoid cells is variable; sometimes the quantity of fibre is great, and the structure is then like lymph-gland tissue hardened by chronic inflammation. In other cases the proportion of cells becomes very large, while the network grows very delicate and open textured. The fixed stellate cells here appear to multiply, and produce a progeny of the loose movable cells in the meshwork, as if infected by the latter. The whole mass then appears as fine filaments

FIG. 6.



making bold meshes, which are filled with round granular cells, the lymph-cells, but generally larger, and having large nucleus and many bright nucleoli. These cells at first appear to make up the whole substance, but they easily brush or wash out of the meshes, leaving the network very conspicuous. It will be noticed that the degree of structure here described is very rudimentary. Indeed, sections of *ante-mortem* blood-clot from within a vein (see figure) closely correspond to the description. So also does tubercle in the more recently formed outer edge of it, where its texture is very like blood-clot; hence it is by some classed with lymphoma. Scarlatinous tonsils and typhoid Peyer's patches likewise have lymphoma structure. However, the plan of structure is so meagre that it is not enough to form a bond of union between diseases clinically so remote.

When found in the form of tumours, more properly so called, lymphoma generally takes its rise in the lymphatic glands; those of the neck are especially liable to it, then those of the abdomen and of the mediastinum. It is also found in the alimentary canal, especially the small intestine and stomach, and in the spleen, liver, kidney, &c. Formations of a similar structure have been met with in various organs in leukæmia, chiefly in the liver, in the form of small grains of a pale substance.

Lymphoma may prove malignant, that is, infectious to parts around, especially when the cellular elements are very numerous (in which case the tumour is called lymphosarcoma by Virchow); it then corresponds to a part of what used to be included under the whole name medullary cancer, which, as formerly used, would include also soft sarcoma and soft carcinoma. Indeed, these tumours, when the cell-elements greatly preponderate, become very like each other, if not undistinguishable, as far as their mere structure is concerned.

Virchow, 'Die Krankhaften Geschwülste,' 1862-5.—*Paget*, 'Surgical Pathology,' 1870—*Abernethy*, 'On Tumours.'—'Pathological Society Trans.'—*Wilks and Moxon*, 'Pathology.'—*Billroth*, 'Eléments de Pathologie Chirurgicale,' 1868.—*Holmes*, 'System of Surgery,' 1870.—'Debate on Cancer of Pathological Society,' 1874.

SURGERY OF THE CUTANEOUS SYSTEM.

CHAPTER IV.

CONTUSIONS.

Contusion. A "**contusion**" is caused by a blow from a blunt instrument, and is uncomplicated with any solution of continuity of the skin. When the blow has been sufficient to produce rupture of the small vessels in the skin and subcutaneous tissue, an "*ecchymosis*" or "*bruise*" is said to exist; when it so injures the deeper tissues as to cause effusion of blood from rupture of some of the larger vessels, "*extravasation of blood*" is said to be present.

Pain, swelling, and bruising are the three symptoms that consecutively follow a blow. In mild cases, however, the last need not necessarily follow.

Ecchymosis. An "ecchymosis" is an effusion of blood *into* the skin and subcutaneous tissue; it shows itself within a few minutes or hours of the injury, according to the force employed and depth of tissue injured, as a livid red, deep blue, or black patch, this patch in the course of twelve or eighteen hours becoming larger and lighter at its margins. About the third day it assumes a violet tint, on the fifth an olive brown, on the sixth a green, on the seventh or eighth it has a yellow aspect, and this fading into a lemon tint then disappears altogether. An ordinary bruise generally runs through all these stages in about two weeks, the rapidity of the process depending much upon the amount of blood effused and the reparative power of the patient. When no blood has been effused into the skin, but "extravasation" has taken place in the deeper parts beneath a dense fascia, the discoloration of the integuments may not appear for three or four days, and in some cases where the blood has made its way between the tissues, and reached the skin away from the seat of injury, the "ecchymosis" will be at some distance from the spot at which the injury was received; when much effused blood exists the swelling will be great.

On making a section of a bruised part, the skin will be found throughout its thickness infiltrated with blood, and it will feel firmer and thicker than natural, and these points are sufficient to indicate the fact that the bruise had been received during life; for a blow applied to a body after death will never cause such general effusion of blood into the cutis, nor such an increase of firmness in the skin, and the effusion of blood that takes place will be in small quantities and venous, and beneath or upon, not in, the cutis.

Diagnosis from purpura, &c. Neither *purpuric patches* nor those of "*erythema nodosum*" ought to be mistaken for bruises. The general diffusion of the spots over the body in the one case, and the history and general aspect of the other affection, should prevent the error. It should be remembered, however, that in purpuric patients and in "bleeders" a slight blow or pinch may be followed by a severe bruise.

A slight contusion may only be followed by some local pain and swelling, the swelling becoming red, and then disappearing. The wheal that rises after a lash with a whip is the best illustration of this fact.

Rupture of vessels after contusion.

A severe contusion may cause a rupture of a large artery or vein, and thus cause a fatal extravasation; or it may so crush or pulp the tissues as to destroy their vitality; a spent cannon-ball may do this. More frequently, however, a severe contusion causes a separation of the skin from the deep fascia and parts beneath, with more or less extravasation of blood into the split tissues. The effects of a contusion also vary according to locality; thus, in an adult a blow over the scalp may be followed by a local effusion of blood, and in a child this effusion may go on so as to form a swelling, involving more or less of the whole vertex. In the buttock and loins blood may be so effused as to give rise to a large fluctuating tumour. In the loose cellular tissue of the scrotum an effusion of blood may give rise to enormous enlargement, and in the eye every one is familiar with the change. Where the extravasation of blood has been extensive, the removal of the clot is a work of time. In some cases the blood remains fluid for a long period, at length becoming absorbed; in some it breaks down, and gives rise to suppuration. In exceptional instances it becomes apparently encysted, and "there is sufficient reason to believe," says Paget, "that blood extravasated in a contusion may be organized, requiring the character of connective tissue, becoming vascular, and taking part in the repair of the injured tissues;" these changes are seen in the repair of fractures, and in ligatured or twisted vessels.

Treatment of contusions.

Treatment.—A slight bruise requires no treatment; if left alone it will get well; for blood is rapidly absorbed, as is seen in the eye. *To check extravasation* cold is the best application, in the form of pounded ice in a bag, or a mixture of salt and saltpetre, or the ice poultice;[1] this, with elevation of the part and rest, are the best means. Should any disposition to inflame appear, some lead or spirit lotion may be used. To hasten on the absorption of the effused blood, tonics are often of use, and the application of gentle pressure by means of bandages or strappings.

Local stimulants.

A lotion of the tincture of arnica, one ounce to a pint of water, seems to have some influence in hastening the absorption of blood, and Friar's balsam with carbolic acid is also of use. Some of the stimulating liniments, such as the soap or opium liniment, may likewise be employed.

In more severe and extensive effusion of blood, when the circulation in the part is interfered with, cotton wool or lint soaked in oil and covered with cotton wool are the best dressings; warmth is thus maintained in the part; moist applications are not so good.

When the blood remains fluid, the Surgeon must not be tempted to draw it off until all hope of its absorption has been abandoned. To meddle in these cases is often injurious; but when the blood has broken up and suppuration has appeared, a free incision into the part, followed by the application of a poultice, is good practice, the cavity being kept clean by syringing with Condy's fluid or carbolic acid lotion.

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[1] *Ice poultices*, as suggested by Maissoneuve, appear excellent things for the local application of cold; they are made as follows:—Take of linseed meal a sufficient quantity to form a layer from three quarters to an inch thick, spread on a cloth of proper size; upon this at intervals of an inch or more, place lumps of ice of convenient size—of a big marble—then sprinkle them over lightly with the meal, cover with another cloth, folding in the edges to prevent the escape of the mass, and apply the thick side to the surface of wound. The exclusion of air retards the melting of the ice, and the thick layer intervening between it and the surface prevents painful or injurious contact; for injuries to the abdomen this expedient seems very applicable. Dr. W. H. Doughty, of the U. S. A., speaks highly of it. Circular No. 3.

When incision necessary.

When the fluid blood has to be evacuated, it should be by a free opening, unless it can be drawn off by the "aspirator," or exhausting syringe, by means of which the fluid is taken out, and no air let in.

Wounds.

Wounds of soft parts.

Varieties.

When the soft parts of the body are divided by any mechanical force applied externally, they are said to be wounded; when the "solution of continuity" is produced by a sharp-edged instrument, the wound is called "*incised;*" when with a pointed one that stabs or pricks, "*punctured;*" when with a blunt instrument that tears, "*lacerated;*" when with any implement that bruises, "*contused.*"

When the parts are only divided, the wound is called a "*simple*" one; when associated with the introduction of foreign bodies, accompanied by hæmorrhage or pain, "*complicated.*"

All the above wounds are described as being "*open,*" the outer part of the wound so gaping as to expose the deeper parts, this term being applied in contradistinction to the "*subcutaneous*" wound, or that in which the external wound is very small in comparison with the internal.

Incised wounds.

Incised wounds, as made by accident or operation, *gape* much when the divided tissues are on the stretch, or the wound is transverse, and in some localities this gaping of the wound is more marked than in others, the elasticity of the skin and possibly its muscularity influencing this result. Thus, in the sole of the foot and palm of the hand, the separation of the edges of a wound is very slight, when in the full mammary gland or in other parts of the body in which there is abundance of fatty tissue beneath the skin, the gaping is very great.

The skin is the most elastic tissue in the body, and retracts on division more than any other; arteries, probably, stand next, and muscles third, these points being well exemplified in a flap amputation.

Hæmorrhage.

The "*bleeding*" that attends an incised wound depends entirely upon the size, number, and character of the vessels divided. In most people the division of *capillaries* stops by natural processes, except in subjects of the hæmorrhagic diathesis. *Venous* bleeding also, except from large trunks, usually soon ceases on elevating the part or on the application of a little steady pressure. *Arterial* hæmorrhage will be profuse when from large vessels, or persistent till the bleeding vessel has been secured by torsion or ligature.

The *pain* attending an incised wound varies in its nature and degree, according to the sensibility of the patient and position of the wound, the pain of anticipation doubtless aggravating it in the case of an operation.

Treatment of incised wounds.

TREATMENT.—*To arrest bleeding* is the Surgeon's first aim, and in the chapter on hæmorrhage the necessary means will be discussed. To *clean the wound* by the removal of all foreign material is the next, and this is to be done by the fingers and forceps of the Surgeon, and a stream of water over the part, aided by cotton wool, clean sponge, or tow. The less manipulation the surface of the wound is subjected to the better.

Where primary union is wanted, the cut surfaces and *edges of the wound are to be brought into apposition* by means of sutures and probably strapping, these objects being materially assisted, when the wound is a deep one, by pads and the pressure of a bandage. Indeed, in the treatment of all large wounds, whether the result of accident or operation, in which primary union is a want, the benefit of a little firm pressure over the part is very great; in some cases a pad of lint being the best material to employ, in others cotton wool, while the whole is kept together by some good strapping or a bandage. Where the edges of a wound can be brought together without sutures or strapping, a pad of dry lint fixed over the part by a bandage is a good dressing. Small and superficial wounds may be brought together by strapping, sutures being only employed when the length of wound is too extensive, or there is too much gaping, or where, as on the face, strapping cannot be accurately applied.

In superficial wounds the flexible collodion of the British Pharmacopœia may be used, the edges of the wound being held in apposition whilst it sets. Two or three coatings should be applied.

In wounds where sutures are not required, and the edges can be brought together, lint saturated with the compound tincture of benzoin is the best application.

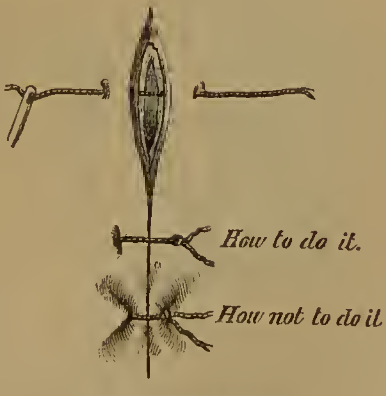
On sutures.

Sutures in superficial wounds may be put in superficially, but in deep wounds must be put in deeply. To adapt the skin surfaces of a deep wound without procuring apposition in the deeper parts is bad practice, and, where union takes place, tends to harm, by holding in the secretions. Sutures are not, however, to pass through muscles. There are four chief kinds of sutures: the *interrupted, uninterrupted, twisted,* and *quilled.*

Interrupted suture.

The interrupted suture is the one usually employed in ordinary wounds. It is made with a curved or straight needle, according to convenience, armed with a single thread of well-waxed silk, the fine silk line sold by tacklemakers being the best. The needle is then introduced through one side of the wound from without, inwards, obliquely through the tissues, and made to pass through the opposite side in the same direction from within, outwards. The edges of the wound are then to be carefully drawn together, and the two ends of the suture fastened in a double-reef knot. A granny (Fig. 105) is by no means a bad knot to make, as it is a slip knot, and may be tightened at pleasure, a third knot securing the whole. The knot of the suture should be brought to one side of the wound (Fig. 27); and in fastening the suture it is only necessary to draw the knot tight enough to keep the edges of the wound in apposition, and not to strangle them, as illustrated in Fig. 27. In a large wound, sutures and strapping may

Fig. 27.



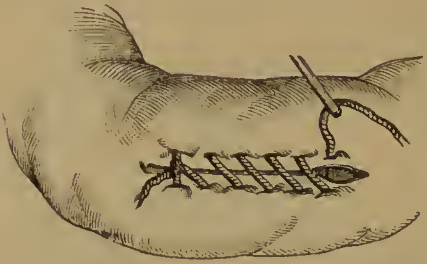
The interrupted suture.

alternate; in others the sutures may be inserted about half or three quarters of an inch apart.

Uninterrupted suture.

The uninterrupted, continuous, or Glover's suture is usually employed where a very close and accurate adaptation of the margins of the wound is wanted, as in wounds of the intestine, of the eyelid, of the face, and of the penis after circumcision in the adult; also after the removal of the breast or other tumour. For this purpose the needle should be small and the silk fine; it is the stitch of the sempstress. Fig. 28 illustrates the suture as applied to the intestine.

FIG. 28.



The continued suture as applied to the intestine.

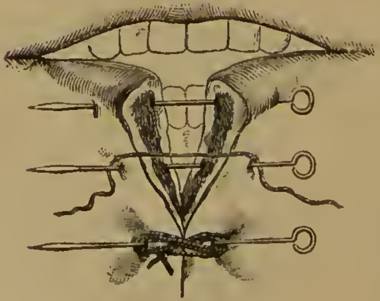
In both these forms of suture the stitches should be removed on the third or fourth day; from the face they may often be taken out on the second. If left in long they set up irritation and ulceration.

Wire, iron, or silver sutures are liked by some; they are thought to be less irritating than silk. I have tested them together in the same wound on many occasions, and have failed to find this true. They are not, however, more irritating, and may be used. They need not be tied, a double twist being sufficient to secure their ends. Wire sutures at times, however, set up very little irritation. Gut and horsehair seem to be the least irritating materials we possess for sutures; in plastic operation they should be used.

Twisted suture.

The twisted suture is the one which used always to be employed for bringing together the parts after the operation for harelip; it is now often so used, as well as in cheiloplastic operations and others on the face and abdominal walls. To apply it, some fine pins with flat heads, silk, and cutting pliers are wanted.

FIG. 29.



The twisted suture.

The pins are employed to bring the *surfaces* of the wound in contact. In lip cases, the point should be introduced half an inch or more from the margin of the wound, and passed obliquely through its thickness down to, but not through, the lining mucous membrane (Fig. 29). It should then be introduced into the opposite side and brought out through the skin at a corresponding point. With a piece of silk the wound may then be drawn together by means of a figure-of-eight twist around the two ends. Should the apposition of the surfaces be imperfect, the pin should be taken out and readjusted, and in this lies the great advantage of this form of suture. A second and third pin may then be introduced in the same way. After the silk has been tied in knots and the ends cut off, the points of the needles ought to be removed, and the soft parts protected, if necessary, from the ends by a small piece of lint or strapping passed beneath.

Instead of silk being twisted round the pins, a section of an india-rubber tube, in the form of a ring, has been employed by Mr. Gariel much in the same way as Mr. H. Lee applies his india rubber over a pin employed for varicose veins, either of the extremities or testicle. I have tried the plan in many cases, and find it good, but no better than silk.

Quilled suture.

The quilled suture is a very valuable one, particularly in deep wounds, tending more than any other to keep the parts in apposition. In plastic operations in the perinæum in the female it has always been a favourite, and although I gave it up in these cases for many years in favour of metal sutures, I now use it with good success. In gastrostomy it is probably the best we possess for holding equably the margins of the open stomach to the edges of the wound, as it is in other cases of abdominal cysts, ovarian and otherwise, in which the same end is sought.

For the application of this suture a strong curved needle with an eye at the end and threaded, is to be inserted at least three quarters of an inch from one margin of the wound, and made to pass well down to its depths, being brought out through the other margin in a corresponding line. The loop of the suture is then to be caught and held, and the needle withdrawn; a piece of bougie, cut the required length, being introduced into the loop, and fixed by drawing the free ends of the ligature home (Fig. 30), a second or third suture is to be applied in the same way. A second piece of bougie is then to be tied in the same way on the opposite margin of the wound, the parts having been well cleansed previously, and carefully adjusted. The surfaces of the wound are only to be held closely in apposition, they are not to be pressed too firmly, otherwise the bougies will set up ulceration. Superficial sutures may subsequently be introduced into the edges of the wound. (Fig. 31.)

Fig. 30.

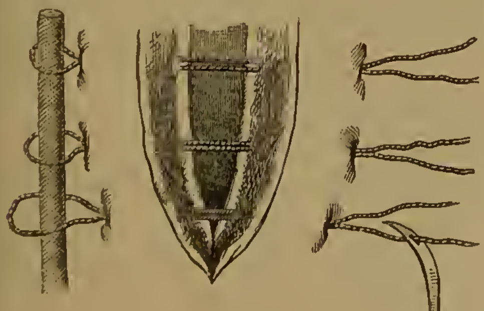
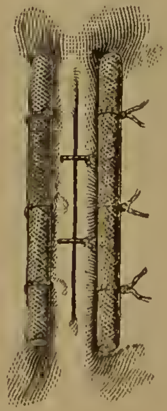


Fig. 31.



The quilled suture.

For the quill suture good fishing gut is better than silk or wire; it being strong, and unirritating. It should, before using, be soaked in water to make it limp; it can be readily tied or fastened with a shot. The loops of the quill suture should generally be divided on the fifth or sixth day, this point turning on the amount of irritation the bougie causes.

After-treatment of wounds.

When the edges of an incised wound have been brought together and well adjusted by sutures, they rarely require more protection than that afforded by a piece of dry or oiled lint; and wounds of the face may be left exposed. Dr. Krönlein, of Zürich, indeed, advocates the open treatment of all wounds.

In wounds of moderate dimensions—on the third or fourth day, when union may be expected to have taken place—the dressings and sutures should be removed, and when the repair is good the parts may be left open.

In gaping wounds.

Should there be any gaping of the wound, or disposition to gape, the Surgeon should apply strips of plaster across its edges as he removes the sutures, in this way giving support to the parts and guarding against their reopening.

When the union between the edges of the wound is poor, and the parts have to heal by granulation, water dressing should be used.

In deep wounds.

In large or deep wounds, where pads and pressure have been primarily applied, it is a better plan to leave the dressings untouched for five or six days, and then only to remove them when evidence exists of the presence of some retained or irritating secretions, for it is better at times even to allow sutures to cut out their way than to disturb a wound in which quick repair is wanted and anticipated. When doubt exists as to the retention of fluids, some of the dressings should be taken away to allow of their escape, for pent-up secretions are most injurious.

On punctured wounds.

Punctured wounds.—When these are made with *sharp* and *clean* instruments, and do not involve any important or diseased structures, they generally do well. When small, they do as well as the incised; when large, they are not so prone to unite by primary union.

When made, however, with *blunt* pointed, *rough*, or *dirty* instruments, they never heal kindly, for the parts are *bruised* and *torn*, as well as separated, by the perforating instrument, and close again as soon as the instrument is withdrawn; thus blood, and at a later stage, broken-down tissues, are retained, and should these decompose or mechanically irritate by their presence, inflammation appears with its local and constitutional symptoms. Should important parts be thus injured, or the tissues be unhealthy, these results will be worse, and very serious consequences may then be looked for.

When tense fasciæ, as found in the palm of the hand, sole of the foot, and scalp, or when deep muscles bound down by fascia, as in the thigh, are punctured, and such results ensue, the consequences are severe.

It is probable that it is the bruising and tearing of the tissues that make these punctured wounds worse than the incised, for bruised and torn tissues rarely heal by primary union.

Treatment of punctured wounds.

Treatment.—All punctured wounds, great or small, are to be treated with more caution than the incised; the parts should be kept at complete rest and elevated, a pad being carefully adjusted over the wound, and equal pressure applied to the parts. When all goes well, and repair ensues, the dressings may be left for four or five days, and then removed, the parts still being kept at rest for another week.

Should pain or swelling follow this primary dressing, and increase, the dressings should be at once removed, and warm water applications or a poultice applied. When there is any evidence of retained fluid in the part, the external wound must be opened, the extent of incision required depending upon the amount of tension of the part. When suppuration has taken place, a free vent for the discharge must be maintained. Pain must be relieved by opium, and the general powers maintained by tonics and stimulants carefully supplied.

Arrow wounds.

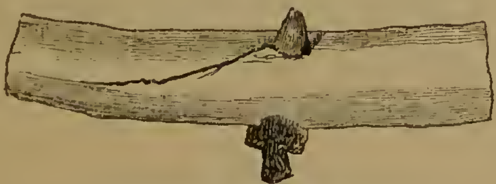
Arrow wounds.

These have been made the subject of a special essay by Dr. Bill in the 'American Journal of Med. Science,' vol. xliv. He tells us that it is exceptional to meet with single wounds, the American Indians discharging their arrows so rapidly that if one takes effect it is immediately followed by others. The Washington Army Medical Museum contains specimens of penetrating arrow wounds of the skull, and where both tables are punctured there is little or no fissuring externally or internally, the vitreous table being penetrated as clearly as the outer. "This is in such marked contrast to the results of bayonet or sword thrusts or of the impact of gunshot projectiles as to merit notice."

Arrow wounds of the chest are not always fatal; those of the abdomen are generally so. Dr. Bill tells us that the Indians on this account always aim at the umbilicus, and that the Mexicans when fighting the Indians on this account always envelope the abdomen.

The velocity of the arrow when first projected is so great that it has been estimated to nearly equal that of a musket ball. At a short distance an arrow will perforate the larger bones without comminuting them or it will cause a slight fissure only, resembling in these respects the effect of a pistol ball fired through a pane of glass a few yards off. This is well seen in the drawing (Fig. 32), taken from a preparation of the section of the eleventh right rib of a buffalo fissured by an arrow, in the Washington Army Med. Mus., presented by Prof. Joseph Henry and copied from Circular No. 3.

FIG. 32.



Piece of buffalo rib, pierced by arrow.
Surgeon-General's Office, U.S. Circ. 3.

The treatment of punctured vessels and cavities will be found in the chapters respectively devoted to those subjects.

Contused and lacerated wounds.

Contused and lacerated wounds never heal by primary or immediate union. The injured parts are so bruised and separated that some portions of their surfaces are sure to die, and thus healing by granulation is to be looked for. They do not bleed like the incised.

They are, nevertheless, to be treated with care, and as if they mean to unite partially if not wholly. After their surfaces have been cleansed and freed from blood and dirt their edges may in many cases be brought together, sometimes by sutures, in others by strapping, care being always taken that the whole of the wound be not covered in, and that a free orifice is left for discharge. The surface of the wound may be covered with oiled or wet lint. The parts should be well raised and kept at rest.

In the skin lacerations of the extremities it is surprising at times to find how well the parts heal under this treatment, and how large portions of integument that have been torn off, when carefully re-adjusted, unite and maintain their vitality; when the parts are so injured that a fear of sloughing from want of arterial supply is felt, the whole should be wrapped up in cotton wool.

Water or oil dressing with or without opium, carbolic acid, or other drug, may be applied after the primary dressing has been removed, according to the wants of the case.

Sub-cutaneous wounds.

Subcutaneous wounds are interesting subjects of study, for surgeons are now familiar with the fact that tendons, muscles, and even bones may be freely divided with a very small cutaneous wound, and good repair follow, without any signs of inflammation, suppuration, or constitutional disturbance. When a tissue is divided, and its two divided surfaces are left in contact, they will unite as any other wound; when they are separated, the space between them will be filled in with new material, that will organize and assume in time the characters of the divided tissue—at least, such changes occur in tendons.

These facts render the subject one of great interest, and tend to make the Surgeon look out for opportunities of applying the practice to a more extended class of cases.

The treatment of subcutaneous wounds resolves itself into closing the wound with a pad, and leaving the parts alone, allowing them to heal; and the quiet way in which this takes place contrasts most favourably with the repair of open wounds. The non-admission of air, not of "germs," being, probably, an explanation of the difference. This subject will be more fully considered in the chapter on the surgery of tendons.

BURNS AND SCALDS.

On burns and scalds.

A burn is caused by the application of concentrated heat to the body; a scald, by the application of hot or boiling liquid. As a rule, scalds are less severe accidents than burns, as water, the ordinary fluid through which the scald is produced, is never hotter than 212° Fahrenheit; but when any chemical compound is the scalding medium, the effects are, at least, often as bad as the worst burns. The worst local burn I ever saw was when a man put his booted foot and ankle into a pot of molten lead. The limb came out covered with a boot of metal, but destroyed even to the bones. Mr. Aston Key amputated the limb at once below the knee, without removing the metal.

A moderate degree of dry heat applied in the pursuit of a calling indurates the skin and blunts its sensibility; and an ironworker or a blacksmith can manipulate pieces of hot iron that would "burn" ordinary people. Thus, some skins or parts of the body are more sensitive than others, and under the same influence may be differently affected.

Varied effects of heat on body.

The effect of heat, when applied to the body, varies according to its *intensity* and the duration of its application; it may cause a simple redness of the surface or the death of the part. Thus, its *first* morbid effect is mere *redness* and tenderness of the surface, and after a few hours these symptoms may subside, the cuticle possibly desquamating.

First degree.

In the *second degree* of heat, inflammation is the result, this action manifesting its presence by the formation of a *blister*, from the effusion of serum beneath the cuticle.

Second degree.

In the *third degree* the superficial layer of the true skin is destroyed, the *surface appearing* of a *grey-yellowish or brown colour*, not painful unless roughly handled. The vesicles that exist contain a blood-stained or brown fluid. The papillæ of the skin, with its nerves, are first destroyed; but when, in the course of a day or so, the dead surface has been "shed" and the nerves exposed, the pain is very severe, the exposed surface having a reticulated surface.

Third degree.

In the *fourth degree*, the whole thickness of skin is destroyed, with more or less of the subcutaneous cellular tissue, the parts being converted into a hard, tough, dry, and insensible eschar, mottled with blood; vesication does not exist in this degree, all the superficial tissues having been destroyed. The skin surrounding the eschar may be blistered, but where it comes in contact with the injured part it will be drawn into folds from the contraction by drying of the burnt integument, this puckering fairly indicating the important fact that the whole skin has been destroyed. The eschar does not begin to separate for four or five days, an inflammatory zone of redness with pain of some severity indicating the commencement of a process, that will not be completed for two or three weeks. When the slough has come away, and the cellular tissue is exposed with the deep parts, a long and tedious process of suppuration and granulation will have to be gone through for its repair.

Fourth degree.

In the *fifth degree*, the skin with the deeper parts are involved—a black, brittle, charred mass taking the place of healthy tissues.

Fifth degree.

In the *sixth degree*, the whole thickness of a limb is carbonized.

Sixth degree.

These divisions, originally made by the great French surgeon Dupuytren, so well accord with all observation that they have been invariably adopted by modern surgeons; and although, in burns and scalds, one degree passes imperceptibly into another, and in bad cases coexist, in the main points they can be made out.

Prognosis. On extent of surface involved.

Next to the *intensity* of the heat and *duration* of its application, the *extent of surface* involved is the most important point; indeed, as regards life, it is of far greater importance than the other two; for a superficial burn, spread over a large surface—although not locally so injurious as a more severe one—is more fatal; indeed, in the majority of cases of death from burns and scalds, more particularly in children, the risk to life is fairly to be measured by the extent of surface involved; when more than half the body is injured, a fatal result generally takes place; a severe burn of a limited character may be only a local affection.

Thus, the danger to life turns upon many points. In the young and

In the young and old more serious.

the old, all burns or scalds of any extent are serious. At all ages extensive burns, however superficial, are to be feared, and these are serious from their immediate depressing effect upon the system, patients dying from shock, the worst cases being marked by the sensation of *coldness* and persistent *shivering*. When the period of shock has passed—a period varying from twelve to forty-eight hours—and that of reaction has set in, other dangers appear. Should the injury be over the thoracic cavity, chest complications may be looked for; if over the abdomen, intestinal troubles. Burns and scalds of the head are not so prone to be followed by intracranial mischief as those of the chest are by thoracic. All intestinal complications should be carefully observed, for there seems to be a liability to irritation of the intestinal mucous tract, that goes on at times to ulceration. Dupuytren first observed this generally, but Long ('Lond. Med. Gaz.,' 1840) and Curling ('Med.-Chir. Trans.,' vol. xxv) showed that ulceration of the duodenum, as proved by inspection after death, and indicated during life by vomiting and purging of blood, is by no means an infrequent result. Pathologists, generally are not, however, agreed upon this point.

Intestinal complication.

Casting off of sloughs.

In the *second* or *inflammatory stage*, the injured parts are being thrown off, and most writers grant about fourteen days for this process, but in some cases less, in others more. When the slough has, however, separated, and the parts begin to suppurate, the *third stage*, or *that of suppuration*, has commenced; and although in this stage there may be less probability of visceral complications appearing, there is the equally great danger of exhaustion, hectic, or pyæmia. Should these risks have been surmounted, there is yet the long and tedious process of the healing of the granulating surface, and at a still later period arise the evils connected with the gradual contraction of the cicatricial tissue. This contraction only takes place when the *whole* skin has been destroyed. When only the surface of the skin has been involved, and not its depth, the sore, on the removal of the slough, has a peculiar net-like appearance, by which it may be known, granulations projecting through the meshes from a whitish or yellow ground.

Suppuration.

Granulation.

Cause of death.

When a person dies from a burn within forty-eight hours, he dies from shock or collapse, pain doubtless often adding to its influence; when he dies during the stage of reaction or inflammatory stage, it is from visceral complication; when during the third or suppurative stage, from exhaustion, visceral changes, or pyæmia.

When a person is said to have been "burnt to death," he dies from suffocation, the fumes of the fire destroying by asphyxia, and the fire subsequently burning the body.

Half the cases of burn admitted into a hospital die, and half of those that die do so within the first three days.

The total deaths in England and Wales in a year from burns and scalds are about 2900, the females being not much in excess of the males.

Statistics of 408 cases.

Out of 408 cases consecutively admitted into Guy's, 275 were in females, 143 in males, the majority being in children under five years old. Dr. Steele has also shown in his 'Septennial Report of Guy's, 1868,' that out of 195 cases of burns from fire, 60 per cent. died; of 169 scalds, 16·5 per cent. died; of 18 burns from gas explosions, 11 per cent. proved fatal; and of 28 cases of burns from gunpowder, 14 per cent. died, the difference between these classes of cases being very great, burns being four times as fatal as scalds, these half as fatal again as gas explosions, &c.

Pathology.

Pathology.—Holmes has gone into this question better than any author ('System,' vol. ii), and has given us an analysis of 68 fatal cases examined after death. Nine died from shock in the first two days, all being children; 17 from exhaustion, 5 within the week, and 12 at later periods. In 3 cases in which the scalp was burnt, erysipelas proved fatal; in 3 pyæmia, and in 2 tetanus; in 11 cases of children cerebral complications caused death, and in most of these they appeared soon after the accident; in 6 cases inflammation of the larynx proved fatal, evidently from the direct inhalation of the flame; in 12 cases, in all of which the burn was thoracic, chest complications killed; in 4 only did abdominal mischief prove fatal, and of these, one had peritonitis, the result of a deep burn, two had hæmorrhage from ulceration of the duodenum, and one had vomiting from the same cause.

Holmes and Erichsen also dwell upon the fact that cerebral and general visceral congestions are always present in fatal cases; indeed, in all, the congestion is a passive condition, due to the "sudden revulsion of blood from the surface," caused by the skin injury.

Ulceration of the duodenum.

With respect to intestinal complication, it seems that out of Holmes's and Erichsen's 125 fatal cases, 16 presented ulceration in the duodenum, 5 of which died during the first week and 5 in the second, the situation of the burn in all but two being on the chest or abdomen. "The ulcer always has an indolent aspect, and is situated below the pylorus; often there are two or three close together; the edges of the ulcers are not raised nor everted; there is little or no evidence of inflammatory effusion in their neighbourhood; when they are recently formed, they look simply as if a portion of the mucous membrane had been cut out; but when the ulcer has penetrated more deeply, so as to threaten perforation of the gut, lymph may often be found effused on its peritoneal surface. Sometimes the glands of the duodenum may be found enlarged." (Holmes.)

The symptoms of duodenal ulceration are most obscure; neither pain nor tenderness exists; diarrhœa is neither constant nor excessive; vomiting is perhaps a more common symptom, and the presence of blood in the motions is highly suspicious. When the ulcer has perforated the intestine, intense pain, vomiting of blood, melæna, collapse and abdominal distension, mark the fact.

It should be noted that cicatrized duodenal ulcers have been found in patients who have died of other complications.

Treatment of burns, &c.

Treatment.—In all burns great care should be observed in removing the clothes and in saving the cuticle. Blisters should be carefully punctured and their contents evacuated, the raised cuticle being gently pressed down to the true skin and covered by dressings. When the patient is cold, or shivering exists, he should be covered with a warm blanket and placed near the fire, some wine or brandy and hot water being given. Professor Hebra speaks well of the warm bath under these circumstances. When the injury is extensive, one part should be uncovered and dressed before the other, for a free exposure of the surface tends to increase the shock and add to the pain.

Exclusion of air.

As pain is the constant concomitant of all burns and scalds, and the exclusion of the air from the injured surface is the best means of

Local applications.

neutralising it, the Surgeon's object has been to find some method of treatment by which this result can be secured, and at Guy's Hospital the application of carron oil, equal parts of lime water and linseed oil, applied on lint and covered with cotton-wool, has long been the favorite remedy, the whole being carefully kept in place by a bandage. At University College the burnt surface, of whatever degree, is well covered with the finest wheaten flour by means of an ordinary dredger. At the London Hospital the application of zinc ointment on lint is employed. Dr. S. Gross, of America, uses white lead paint, and, more recently, powdered clay has been employed. The dressings must not be changed for some days, not, indeed, until they have been loosened by the discharges or become offensive, for the process of dressing any large burn is necessarily a painful, and consequently an injurious one. For this reason carbolic acid has been dissolved in the oil, in the proportion of one part to ten or more.

In slight cases.

Small burns or scalds may be treated by water dressing, lead lotion, collodion, Friar's balsam, gold-beater's skin, flour, chalk and water, &c. Two parts of collodion to one of castor oil is also a good application. In superficial burns this treatment is probably all that is required, the cuticle being re-formed in three or four days, and beyond some increase of redness in the parts the cure is nearly complete.

Use of carbolic oil.

When the *first* dressing has been removed and the Surgeon is able to make out the extent of tissue injured and the depth of the sloughs that are expected to separate, the character of the dressings may be altered, for it is best to hasten the sloughing process, which may be done by some stimulating dressing. Lister's carbolic oil, made of one ounce of carbolic acid to a pint of olive or linseed oil, is very good, or an ointment made of carbolic acid ʒiv, lard ℥iv, and castor oil ℥j; but these drugs will not do when a very large surface is involved, and under such circumstances they had better be applied to the sloughing parts, and the carron oil, or zinc, calamine, resin, or creosote ointment, ♏x of the last to an ounce of lard, to the other parts. A lotion composed of one drachm of the compound tincture of iodine to a pint of water is a good one. Sloughs, as they loosen, should be cut away, but never dragged. Deep sloughs are well treated by poultices, the turpentine ointment hastening their separation. When the surface is granulating it must be treated as any other open sore, and when the entire thickness of skin has been lost, as in burns of the fourth degree, the Surgeon's closest attention is needed to counteract the contraction of the wound that will take place, and thus prevent the advent of those frightful deformities with which all are too familiar.

Sloughs to be removed.

Prevent contraction.

This is to be done by extension, applied in some instances through mechanical appliances, in others by means of bandaging and strapping. When strapping is used, the pressure should be exerted over the granulating surface as well as over the cicatricial border. The strapping must be good and made of linen, thin calico and leather yielding too much; in the majority of cases nearly all requirements can be met by these means. The process of extension must be kept up during the whole period of granulation and cicatrization. Thus, in burns of the anterior surface of the neck the chin must be extended to the utmost from the sternum; in those of the thorax the arm must be kept from the side; where the groin and parts around are involved, the thigh must be kept extended, &c., &c.

In addition, however, to these means, we possess M. Reverdin's method of skin grafting; a practice consisting of the transplantation of small portions of true skin, these centres of cutification not only rapidly growing in healthy granulations, but having the power of imparting to the granulating tissue a skin-forming power which is as remarkable as it is beautiful to witness.

Skin grafting.

By these means large granulating surfaces may not only be rapidly healed, but healed without such a surface of cicatricial tissue as necessarily exists in ordinary burns or sores, and without, therefore, that tendency to subsequent contraction that appertains to cicatrices.

This suggestion has introduced us to a new field of surgery, which promises to make a large class of cases that were previously an opprobrium to our art as remediable as many minor affections.

It will receive due attention in a later page.

When a hand or finger, foot or toe, is charred, amputation must be performed; where the soft parts are so injured as to slough, the same practice must be adopted; where a large portion of the body is thus affected, an opportunity for treatment is rarely afforded, the accident being fatal. The time and also the necessity for operation must be left to the judgment of the Surgeon.

When amputation necessary.

The constitutional treatment of burns, in the first stage, is to *prevent collapse* by the judicious use of stimulants and external warmth; *allay pain* by local treatment and soothing drugs, such as chloral or morphia; *maintain the powers of the patient* by simple nutritious food, such as milk, beef tea, eggs, &c.; and *after* the stage of reaction, when that of suppuration has set in, by good food of all kinds and tonic medicine.

Constitutional treatment of burns, &c.

Complications are to be treated on ordinary principles, always remembering that the injury is a depressing one, and that it needs no additional depressing influence in the way of treatment.

Thoracic complications may be met with moderate doses of tartar emetic and salines, with nutritious and possibly stimulating diet.

Abdominal complications, with opium, alkaline remedies, such as lime water in bark, and simple diet.

For children an opiate is best given in the form of the opium ointment; and for adults, where the drug upsets digestion, the same plan is a good one.

Scalds of the glottis will be considered in Chapter XVIII.

Burns and accidents from lightning occur but rarely in this country. They average about twelve a year. In 1861 they were twenty-six, in 1862 twelve, in 1863 three, and in 1864 six. Holmes, who has written a careful compilation on the subject, tells us that a person struck by lightning is usually more or less completely deprived of consciousness at the time. This is a consequence sometimes of the shock given to the brain, and is accompanied by more or less paralysis of motion and of sensation, common or special. Sometimes, and perhaps more usually, it is the effect merely of fright, and is then only transient. The insensibility sometimes lasts for a considerable time. The paralysis by which it is usually accompanied may last for an indefinite period; in one case it lasted four months, in another three. This paralysis is more common in the lower limbs than the upper. Other affections caused by lightning are burns, eruptions of erythema or urticaria, loss of hair over parts or the whole of the body, wounds, hæmorrhage from

Effects of lightning.

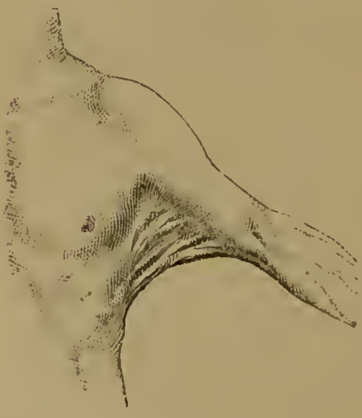
the mouth, nose, or ears, loss of sight, smell, speech, hearing, and taste, or, in rare cases, exaltation of these special senses, cataract, imbecility, or abortion. It sometimes leaves arborescent marks on the body, even on parts covered by clothes, which have often been described as a kind of photograph of neighbouring trees or other objects. Persons not killed on the spot usually recover, though some die from exhaustion; Treatment. recovery is hastened by tonic treatment; galvanism is good in paralysis. Burns caused by lightning are deep and obstinate; sometimes, however, mere vesications; they must be treated as other burns.

In sudden deaths from lightning the shock to the brain is the cause; the heart is found flaccid and empty, the blood sometimes coagulated, and Taylor tells us, from Sir C. Scudamore's experiments, that in animals killed by electricity the same conditions existed.

The diseases and treatment of cicatrices.

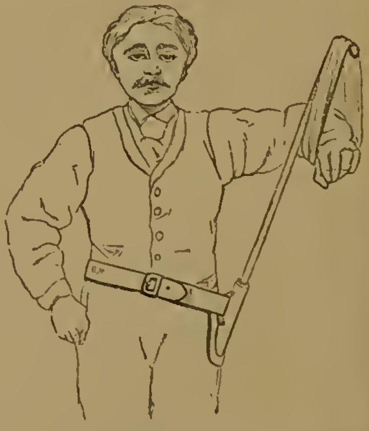
On cicatrices. Cicatrices or scars, however produced, grow with the growth of the individual, and, at the same time, have a tendency to disappear, so that indurated scars may, indeed, in time become non-indurated. In small scars this is often observed, and even in larger it is so occasionally, the Disposition to contract. large cicatrices of burns becoming soft and pliable. As often as not, however, the opposite occurs, and the disposition to contract is a very formidable one, producing deformities of a frightful kind; those of the neck are, perhaps, the most hideous. The arm may be fastened to the side (Fig. 33), and I have seen in one case the head of the humerus displaced forwards beneath the clavicle, and in a second beneath the coracoid process and the development of the upper extremity arrested by the contraction; indeed, there is no limit to the effects of such a powerful and constant force as that of cicatricial contraction.

FIG. 33.



Axillary cicatricial web after burn.

FIG. 34.



Mode of applying extension after its division.

Operative measures. The Surgeon is called upon not unfrequently to remedy these defects, and where his efforts are successful the surgery is satisfactory, but too often the result is far from what is wanted.

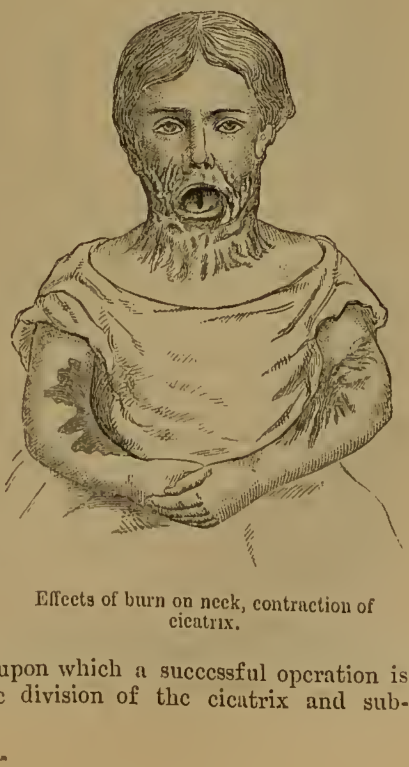
The operation consists in the free division of the cicatrix and its subjacent tissues, the subsequent extension of the divided parts during the healing process, and the transplantation of different centres of "cutification" during the granulating stage, after the method of Reverdin.

Modes of performance.

In dividing the cicatrix the incision may be directly across the scar, running into healthy tissue on either side, or in the form of a natural or inverted V, according to the line of induration, the V flap being dissected from the tissues beneath; or a number of small incisions may be made, subcutaneous or otherwise. But in all these divisions the Surgeon must remember that the seat of the contracting cicatricial material is in the subcutaneous tissue as well as in the skin, and that unless that be divided no permanent good can be looked for; indeed, it is on this point, and upon it alone, that a prognosis can be based. The most favorable cases for operation are those in which a web of tissue connects an extremity with the body, or the chin with the chest, for such a web contains within itself most of the cicatricial material upon which the deformity depends, and on its division the whole will be freed. Great care is, however, needed in the division of these webs, for they often contain important parts, such as nerves and vessels that have been displaced by the contracting process. Thus, in treating a case in which the right arm was fixed by a web from the axilla and elbow to the chest, the web seemed to be so cutaneous that I was half tempted to perforate with my knife and slit it up. Had I done so, in the position I had noted, I should have passed my bistoury across the brachial plexus, artery, and biceps muscle—these parts having been completely drawn across to the thorax by the affection—and have then been forced to amputate the extremity. I did, however, what I would always advise others to do — divide the parts carefully and deliberately, and thus steered clear of any harm. I brought also a piece of healthy skin from the posterior part of the wound and fixed it to the anterior, about the lower border of the axilla, thus dividing the large exposed surface by a bar of healthy integument, and kept the arm at a right line to the shoulder with a splint extending from the elbow to the hip. When the wound had assumed a healthy aspect I inserted ten pieces of skin, the size of hemp-seed, and after this, cicatrization went on with wonderful rapidity, the child recovering with a natural arm and moveable cicatrix. In this case I have fairly indicated the points upon which a successful operation is to hinge: — Free but deliberate division of the cicatrix and sub-

Example.

FIG. 35.



Effects of burn on neck, contraction of cicatrix.

Points to be observed in operation.

cutaneous tissue; extension from the first, during the healing process, by some fixed mechanical appliance; and skin transplantation when the surface of the sore has assumed a healthy granulating surface; the Surgeon, where he can, partially detaching a piece of integument from one side and connecting it with the opposite, in order to divide the wound, and thus increase its skin margin for granulation. Where a bend in a joint exists this practice is still more valuable. After the operation the wound should be dressed with oiled lint and covered with cotton-wool, as in a burn. Fig. 34 illustrates a simple method of applying extension of the arm after the division of an axillary cicatrix of great size. Fig. 35 illustrates the effects of a burn upon the neck.

Section of jaw in deformities.

In *deformities affecting the jaw*, in which immobility of the bone has been produced, Esmarch and Rizzoli have proposed the division of the bone at the fixed side and the excision of a small wedge of bone, with the view of making a false joint. The operation is a sound one, and has been done with success by Mr. C. Heath. In suitable cases it should be repeated.

Ulceration of cicatrices.

Ulcerating cicatrices are not uncommon, an old scar breaking up and becoming the seat of an indolent sore, when its possessor has been weakened by any fever or exhausting process. I have seen this occur over and over again in adults, as they get old or feeble, in cicatrices received in infancy. In one case the cause of the scar was a burn, in another it was an injury, in a third an operation, but in all the scars were alike, and they underwent the same degenerating process. These sores require to be treated by rest and local stimulants, the patient being given tonics and good food, to improve the weakened powers. In one case I transplanted with complete success. These "cicatricial sores" are, however, always obstinate, those over the ends of bones the most so.

Warty and cheloid scars.

Warty and cheloid scars are classed together, for it is a difficult thing to distinguish the indurated, lumpy, warty scar from the true cheloid. The former, however, appears directly after the wound has healed, and is clearly connected with the healing process, and the latter attacks any scar at any period of its existence.

The thickened warty scar appears as an induration of the whole cicatrix, and is often associated with heat and irritation. It is best treated by local stimulants, such as iodine or blistering fluid, the object being to break up, by some local inflammatory process, the lowly organized fibrous production.

On cheloid tumours.

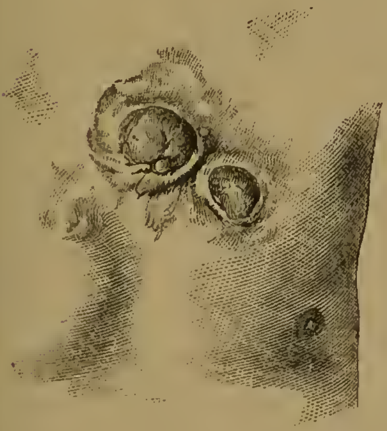
Cheloid tumours grow as indurated smooth tubercles, at first having a red or pinkish colour, but as they increase becoming pale. They are at times painful, or, at least, irritable. They rarely attain a large size, and had better be left alone, for they are apt to return in the cicatrix formed after their removal. Cheloid tumours generally grow from cicatrices. These cheloid tumours are known as those of Alibert, to distinguish them from those described by Dr. Thomas Addison, who, in 1854 ('Med.-Chir. Trans.'), described another form of cheloid which he called the "true cheloid," the induration beginning in the skin and subcutaneous areolar tissue, and often going on to produce such a contraction of the part affected as to resemble the indurated cicatrix of a burn. Figs. 36, 37 represent the two affections.

The cheloid tumour which follows the perforation of the ear for an ear-ring is a curious form, and seems less liable to return than other cheloids; from the deformity it causes it should be excised with a portion of the healthy lobule.

Cancer may attack scars.

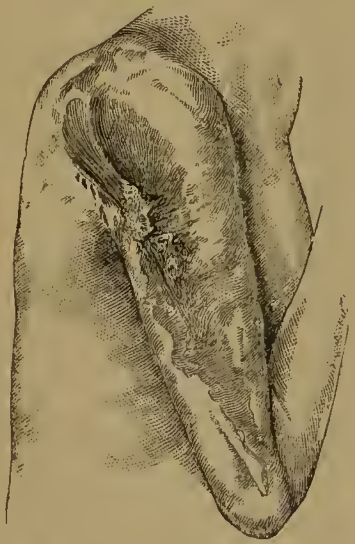
Cancer may attack a scar, and when it does the scars are generally old. Thus, I have treated a man who had a cancerous lip, the disease having developed in a scar he had received fifty years previously; it began as a thickening of the scar, and then showed as a tubercle, which grew, broke down, and ulcerated, the ulceration rapidly spreading. Cancers mostly appear after this fashion. They are usually epithelial. They are to be treated by the removal of the growth.

FIG. 36.



Cheloid of Alibert.

FIG. 37.



Cheloid of Addison.

(From models in Guy's Museum.)

Examples.

I was in December, 1871, called upon to amputate above the knee in a man, æt. 65, a leg stump that was the seat of a frightful cancerous disease. The cancer had existed for two years, and had appeared in the cicatrix of an old amputation performed fifty years before for gangrene after fever (Fig. 18).

Painful cicatrices,

Painful cicatrices are often due to the divided ends of the nerves being bound in by the cicatricial tissue, as often as not they are caused by a bound-down bulbous growth at the extremity of a nerve. In a case I had some years ago the external popliteal nerve, as it wound round the head of the fibula, was so bound down by the cicatrix of a burn as to cause severe agony in the whole course of its distribution. The symptoms were relieved by two free vertical incisions through the cicatrix, and the patient recovered. Should I see a like case I shall do the same thing, but subsequently transplant pieces of skin in the wounds as soon as they assume a healthy appearance. When the pain is due to an adherent or bulbous nerve, the nerve must be freed and removed. When doubt as to its condition exists, Mr. Hancock's sug-

Treatment.

gestion to divide subcutaneously the suspected nerve may be adopted. Where no such causes as have been mentioned are to be made out, the case may be treated as one of neuralgia by full doses of quinine, arsenic, iron, and local sedatives, the extract of stramonium or belladonna rubbed down with glycerine being good applications. Cases, however, of painful stumps or cicatrices are sometimes met with that defy treatment.

Congenital cicatrices.

Congenital cicatrices are met with in practice. Thus, I have seen on two occasions a woman who had a cicatrix in her upper lip as if she had been operated upon for harelip (Chapter XII), and bridles connecting the lip with the gum in an unusual manner are not uncommon.

ON SKIN GRAFTING.

Suggested by Hunter.

When John Hunter a century ago succeeded in transplanting the spur of a young chicken from its leg to its comb, as well as into the comb of a second bird, and found that it not only lived, but grew, he probably never dreamt in any flight of his genius that the fact he then established would be so applied in the practice of surgery as to mark an era in its progress, and to bring a class of cases which surgeons were apt to look upon with little interest amongst the most curable and tractable of local affections. And yet this has come to pass, M. Reverdin, of Paris, having on October 16th, 1869, succeeded in transplanting small portions of skin taken from one part of a man's body to the granulating surface of a large sore, under which treatment the ulcer healed. He read the case before the Surgical Society of Paris on December 15th, 1869, and asked, "Is the growth of skin due to the effect of contact or neighbourhood, or is it due to proliferation of the transplanted elements?"

Introduced by Reverdin.

Mr. G. D. Pollock, of St. George's Hospital, encouraged by M. Reverdin's success, followed up the practice, and the good results he and his colleagues obtained soon induced all other surgeons to follow in their wake. The facts are to be read in the 'Transactions of the Clinical Society' for 1871, and at the present day it may be said that the practice is established.

Since the introduction of this practice I have very extensively carried it out, and in most instances with success. I look upon the suggestion as a very valuable one, its adoption rendering many cases curable that were not so previously, facilitating the cure of as many more, and giving interest to a class of them that had formerly but little. In the management of ulcers it is a great boon, and in the treatment of the large granulating surfaces so common after extensive burns, its value cannot be overestimated; as an adjuvant to many plastic operations, more particularly on the face, and in the case of deformities, it is invaluable.

Effects of operation

Under the action originated by the transplanted skin centres, a process of repair goes on which at first appears almost magical; the grafts soon become islets of skin, round which cicatrization proceeds; the margin of the sore receives an impulse in cicatrization, which rapidly extends; and between the grafts themselves and the margin of the sore connecting links of new skin rapidly form, which divide the sore into sections. (Fig. 40.) By these means large surfaces speedily cicatrize that under former circumstances would have required many mouths, and that, too, without the contractions and subsequent deformities that under other conditions were too well known to follow in such cases.

When applicable.

The practice seems applicable wherever a large granulating surface exists, and the only desirable point to observe is, that the *surface of the sore should be healthy;* this clinical fact including another, that the patient's health is good, for there is no better barometer of health than a sore, its surface assuming a healthy or unhealthy appearance with every alteration in the general condition of the body. I have attempted, by way of experiment, to graft skin upon sores that were not quite healthy, and have sometimes succeeded. In some indolent sores in which a small patch of healthy granulations sprang up, I have succeeded in securing, by transplanting, a new centre of "cutification," that proved of great value in aiding the healing process; but in a larger number I have failed in securing such an end. It may, therefore, be accepted as a truth, *that a healthy granulating surface is an important although not essential requisite for success.*

Upon this basis I will now proceed to consider how the operation is to be performed.

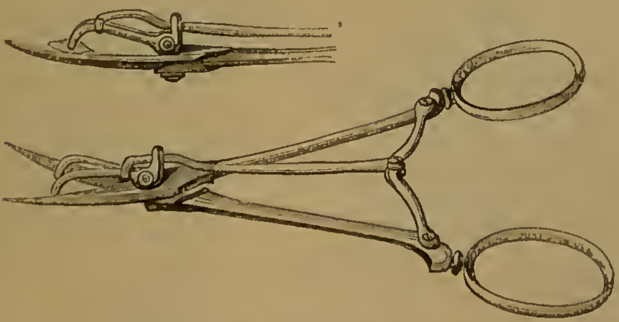
Pollock tells us that Reverdin's method is to remove a very minute portion of the skin, place it on the surface of the granulations, and there retain it with a strip of plaster. "I," he writes, "have usually removed the skin by nipping up a very small portion with a fine pair of forceps, and cutting it off close with sharp scissors. At first I made a slight cut in the surface of the granulations and then embedded the piece of skin; but of late I have only laid it on the surface of the ulcer. I cannot say that I have found any difference in the result. I do not think there is great, if any, advantage to be gained by the transplantation of a large piece, but where the ulcer is large I think much is gained by the transplantation of numerous small pieces. The disadvantage of transplanting a large piece is the sore it creates; while the small sores formed by the removal of the minute pieces heal in a short time, and without trouble." ('Clin. Soc. Trans.,' vol. iv.)

My own experience confirms in every point that of Pollock.

Mode of performing transplantation.

I employ for the removal of the sound skin a pair of scissors (figured below) which Messrs. Krohne made for me after Macleod's suggestion

FIG. 38.



Scissors for skin grafting.

in a medical journal, and find they answer far better than anything else, for they take away a portion of skin that will cut into three or four pieces, and the section includes only the upper layer of the true skin, with the rete mucosum; they do not cut into the fat beneath the skin, or divide the papillæ sufficiently far to draw blood or give pain. Patients never object, with this instrument, to a second or third piece being taken away, should it be deemed necessary. The skin may, however, be taken away with a fine lancet, either by perforation or after its elevation upon the point of a needle. I generally take the skin from the fore part of the arm or the side of the thorax.

Where to place fragments.

Having taken away the skin, the fragment should be cut into three, four, or more pieces, and these placed about *half an inch or three quarters of an inch from the margin of the sore, and about one inch apart;* for there is no doubt that the engrafted centre has a stronger influence in exciting a healing action in the margin of the sore when placed near it, than when isolated in the centre of a granulating surface.

The pieces should be placed upon the granulations, and gently pressed in. There is no necessity to wound the granulating surface. They should be covered with a piece of oiled gutta-percha skin, and the whole supported with cotton wool; a bandage being subsequently applied, so as to press moderately upon the part, and keep the dressing in position. On the third day, but not before, the dressings may be removed, the greatest care being needed, and a fresh piece of oiled gutta-percha skin subsequently applied.

Not to change dressing till third day.

The appearances of the engrafted pieces on the removal of the first dressing vary considerably; at times they will seem palpably to have taken root and to be alive; at others to have disappeared altogether; whilst in a third class the surface of the cuticle will be seen floating, as a thin film, upon the secretion of the sore, the basement membrane of the cuticle—the essential part—being left. (Fig. 39.)

FIG. 39.

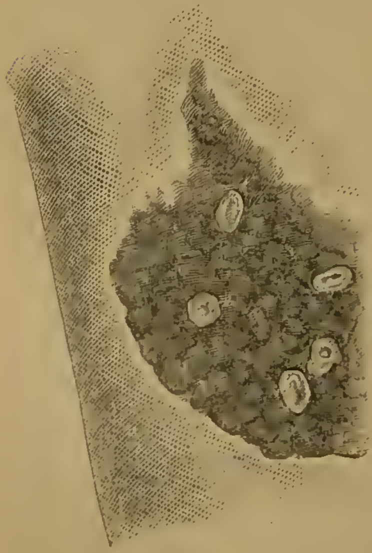
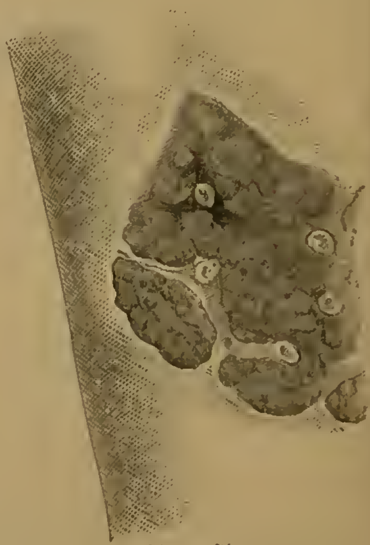


FIG. 40.



Drawings illustrating the cicatrization of sores by skin grafting

Care in removal of dressing.

Under all these circumstances, however, the surface of the sore is to be cleaned with the greatest care, a stream of tepid water, either squeezed from a sponge or injected from a syringe over the part, being the best means to employ. The surface is on no account to be wiped, for the grafted portions of skin are easily uprooted, whilst those that seem to have died or that have disappeared often show themselves again later as "cutifying centres." As soon as the new centres are established in large sores, other pieces should be engrafted, at about the same distance from the new pieces as these were originally inserted from the margin of the sore; and in this way the whole granulating surface may be speedily covered with new skin, and a rapid recovery take place.

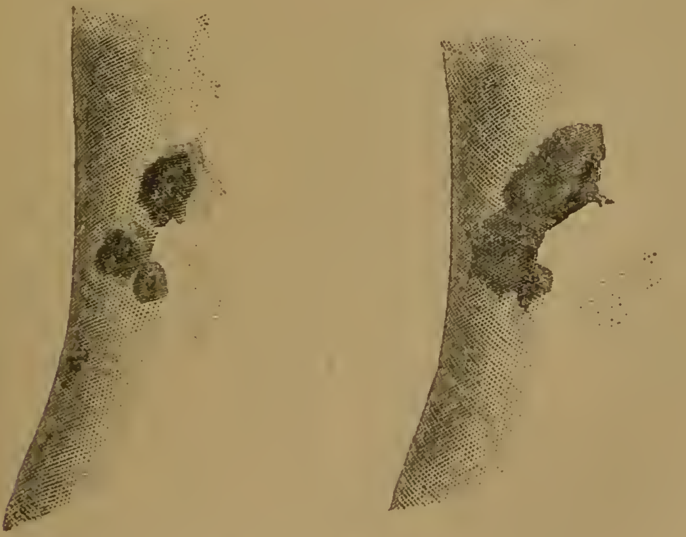
How engrafted pieces act.

How the engrafted pieces act in the healing process is not yet satisfactorily settled, and Reverdin's questions, already quoted, have not yet been completely answered. That they act as direct stimulants to the sore itself, and more particularly to the margin of the sore, there can be little doubt, for as soon as the "grafts" have taken, the margin of the sore nearest to them is seen to cicatrize and to send out prolongations of new cicatrizing tissue to meet similar prolongations from the new cutifying centres: the sore in this way becoming subdivided by bands into smaller sores, and then rapidly healing. (Fig. 40.)

How engrafted pieces grow.

That the engrafted portions grow by the proliferation of their own cells is likewise proved by the fact that in the case of a white man upon whose ulcerated leg I engrafted four small pieces of black skin, the whole being no larger than a barley-corn, the black skin grew twentyfold in ten weeks, to the extent illustrated in Fig. 41, the black

Fig. 41. Fig. 42.



Drawings illustrating the growth of black skin when grafted on to the sore of a white man.

portions gradually enlarging and sending out prolongations, which joined, till one patch of black skin had formed, as seen in Fig. 42, the ulcer healing as rapidly where the black skin was grafted, as where the white was placed. The engrafted pieces of new skin thus themselves grow by cell development, they stimulate the skin-forming powers of the margin of the sore, and exert at the same time a like action on the granulations around.

Pieces may be transplanted from amputated limbs.

The same result may likewise take place when large pieces of skin are transplanted, whether removed from the patient or from some recently amputated limb. The dressers at Guy's have frequently engrafted large pieces of skin, half an inch square, removed from amputated limbs; the pieces on removal being dropped into warm water in their passage to the wards where they are applied. But there seems to be no advantage in adopting this practice in the majority of cases, a large proportion of cases failing. In a case of mine the grafts took root and excited a healthy action in the margin of the sore; they, however, grew but little, and they remained on the cicatrix of the sore, as bosses of skin with well-marked borders; they were grafted, it is true, but the grafts seemed to have no power of assimilating themselves to the tissues on which they were placed (*vide* Model Guy's Mus.).

Not required to take large pieces of skin.

To take large pieces of skin from the patient's own body is an objectionable practice on account of the large wound it creates; it is, moreover, unnecessary in the majority of cases, as small pieces appear to do better. To take them from another subject is also objectionable for like reasons; but still more so on account of the difficulty that sometimes accrues from a want of power in the new graft to assimilate itself to the tissues on which it is placed, and from the risk that is necessarily run of introducing into the blood of the living subject some new or poisonous element; a risk that I believe it to be wrong and unjustifiable to run, and that I would not allow on my own person. On that account I have forbidden my dressers adopting the practice.

Risk in transplanting skin from other subjects.

In the case where black skin was transplanted I did it with the full concurrence of both patients; indeed, both were rather disappointed that the operation could not be repeated. They were firm friends, and the link I formed bound them closer.

May cut the piece into minute fragments.

There seems, however, no objection to mincing the portion of integument which is to be employed into minute fragments, that is, into pieces the size of millet-seeds; the thumb-nail of the Surgeon being the best table for the purpose; in children, where it is unadvisable to remove much healthy skin, and the surface to be covered is large, the plan is a good one; I prefer, however, pieces the size of half a hemp-seed, when they can be obtained. The practice of applying "skin-dust," or the products obtained by scraping the skin, not being followed by success, cannot be recommended.

Properties of the newly engrafted skin.

Whether this newly engrafted skin possesses the same power of resisting disintegrating changes as the old skin is not yet proved. Some observations I have made lead me to suspect that it is in some cases somewhat prone to break down and ulcerate, on the patient walking, after the sore has completely healed, although in others I have found a sore in this way healed is more capable of resisting disintegrating changes than another healed by unassisted natural processes. At any rate, it is necessary to observe as much care in the after treatment of the case as ought always to be observed after the cure of any other sore; and more particularly to afford moderate support and protection to the part, and for this purpose there is nothing better than the binding on of a piece of sheet lead over the cicatrix, when the seat of mischief is on the leg, as by it equal pressure as well as protection is supplied to the seat of the original sore.

The new skin soon becomes as sensitive as the old; indeed, the sensibility of the cicatrix, under these circumstances, seems to be greater than it is when unaided cicatrization is allowed to take place.

Chilblains.

On chilblains.

Chilblains are local inflammations of the skin; they are met with in subjects of a feeble circulation, and are more common in the young, and in women than in men; they are generally seen on the toes, fingers, nose, or ears, and are caused by any sudden change of temperature, or sudden application of cold or warmth.

They are met with as simple congestions of the skin, attended with tenderness or itching; as vesication of the skin, when the inflammation is more severe; or as sloughing and ulceration of the skin, when a broken chilblain occurs. The disease may begin and stop at the first or congestive stage, or run through all the stages, the experience of each subject telling him or her what is to be expected.

Towards evening, the symptoms of irritation are always increased, and any external warmth of a fire or bed, any full diet or stimulating drink, is apt to increase the symptoms; in fact, anything that excites the circulation in the part, at any hour of the day or night.

Treatment of chilblains.

Treatment.—The local treatment of chilblains is no less important than the general, and is more successful; for whilst tonics, good diet, external warmth, and exercise are called for to improve the general powers of the patient and the circulation, local stimulants are of great value. When the chilblain is not broken, the local application of the tincture of iodine, of a solution of sulphate of copper (three grains to the ounce), of camphor liniment, of soap liniment with opium, or one fourth part of the tincture of cantharides, of compound tincture of benzoin, or of simple spirit, not only gives comfort, but hastens the cure of the disease; the part should also be covered with strapping spread on leather.

When the parts are broken, water dressing, with the use of thick lint and oil silk or elastic tissue, are the safest remedies, stimulating lotions being used later, when the parts are indolent in healing. Olive oil ℥ij, Acid. Carbolic. gr. x, and Ext. Opii ʒj, is a good formula.

Warm socks and loose shoes or boots are always indicated, anything like tight boots being most detrimental. Exercise should be practised when possible, and an equal temperature maintained.

Frostbite.

On frostbite.

It has been already shown that the sudden application of cold to any exposed part of the body of a feeble or depressed subject is liable to be followed by "*chilblain;*" and when concentrated cold is applied, under the circumstances, for a period sufficient to arrest the circulation in a part, a "*frostbite*" is the result. Sudden and severe alternations of heat and cold under exposure, even in healthy subjects, may produce this result, and in military life this fact is a familiar one.

Local effects.

The first effect of cold upon a part is a sense of numbness and weight, with a feeling of tingling; to the eye, the skin will probably appear redder than usual; if the part be removed from the influence of the cold at this time recovery may follow, or in feeble subjects a superficial "*chilblain.*" If the cold be, however, allowed to act still further, the parts will become stiff, and at last insensible, feeling "dead." To the eye, they will assume a white and waxy aspect, and be senseless to all impressions, the blood having been completely driven from the surface. When the cold has been suddenly applied, and is sufficient to kill the part outright, the frozen tissue will have a mottled aspect, from the retention of blood within the tissues. Many of these effects may be produced by the æther spray.

Constitutional effects.

The *constitutional effects* of cold are at first stimulating, and subsequently depressing; excitement passes into sleepiness, and this into torpor. If this be yielded to by the sufferer the sleep will end in death, the blood being sent from the surface to the brain and other viscera, death being produced by blood engorgement, as in apoplexy.

In the "sleepy and depressed stage" of cold, if the patient be brought suddenly under the influence of warmth, and placed too near a fire, the risks of lung engorgement are very great, as well as of rapid gangrene of the frozen parts, for by sudden reaction the arterial circulation becomes quickened, and all the parts become gorged with blood which they have lost the power of propelling onwards. In the gangrene from frostbites there seems reason to believe that ulceration of the duodenum may follow, as after burns. Mr. Adams has recorded such a case in the 'American Med. Times' for 1863.

Treatment of frostbite.

TREATMENT.—Few cases require more care, for any sudden alternation of temperature will be most injurious. The aim of the Surgeon is to recall the affected parts *gradually* to their normal condition, to assist the venous circulation by gentle friction in the course of the veins with furs or flannel, and the arterial by comparative warmth applied externally, and gentle stimulants administered internally. No warm water, warm air, or fire is to be allowed to approach the parts until the natural temperature has been partially restored, and then with great care. Friction with snow or iced water has been recommended. On reaction, the parts may be raised and lightly covered with flannel or cotton-wool, or exposed to the warm air of a chamber; food and stimulating drinks carefully given, warm milk with a little brandy being the best. Should reaction be too severe, it must be checked by lead or spirit lotions.

When gangrene limited.

When gangrene follows, and only small portions of the body suffer, such as the integument, the parts may be dressed by some stimulating application to hasten the separation of the slough, and the part generally kept warm, carbolic acid and oil being probably the best application; tonics should also be given.

When gangrene extensive.

When large portions of the body suffer, such as the whole foot—and in this country I have seen a coachman, who had on new tight boots, on a bitter winter day, lose both feet—amputation may be called for, the Surgeon always waiting till the line of demarcation or limit to the sloughing process is fairly marked.

Boils and Carbuncle.

On boils and carbuncle.

These affections are, in a measure, allied; they are both due to inflammation of the skin and subcutaneous tissue, the disease probably commencing in the latter. In both there is effusion of lymph into the areolar tissue of the part, and in both this mostly sloughs, although in the boil the slough is local and confined to one central point, whilst in carbuncle the process may cover an extent of integument varying from the size of half a crown to that of a plate.

Boils of two forms.

Boils are met with in two forms: *one* as a subcutaneous swelling, attended with little pain until the skin over it inflames and suppurates; the conical-pointed swelling, with inflamed indurated areola causing severe distress, until the parts give way, when the feeling of tension and throbbing is followed by relief due to the termination of the sloughing process and discharge of the "core." When the slough has been discharged, an irregular orifice in the skin is seen covering in a cavity in the cellular tissue, which subsequently granulates, leaving a depressed cicatrix. The core or slough is composed of skin infiltrated with lymph.

The *second* form of boil begins as an inflamed follicle or pimple, with a scarlet, exquisitely sensitive areola. It suppurates slowly, occasionally becoming vesicular, and, as a rule, terminates with a less well-marked slough than the former kind. Such boils are more usually multiple than the last, and are often caused by the application of moist dressings, &c., to a part, or of some cadaveric irritant.

Causes of boils.

With respect to the *causes of boils*, nothing definite can be laid down. That they are always associated with some debilitating or allied cause is belied by daily experience, for they are certainly often seen in men and women in whom no such condition exists; indeed, they are met with in subjects who often declare that they "never felt better in their lives." As a rule, however, this is not the case, for they are often found in subjects who have been either fed to excess or been subjected to some sudden change in the nature of their diet, in men who undergo training for athletic pleasures, who are subjected to the influence of fœtid animal exhalations, as in a skin-yard, pathological room, or dissecting-room. They are seen also in the diabetic and cachectic subject, in patients enfeebled by any fever or other debilitating cause. Gamgee tells us that they are often the result of eating diseased meat. They are also produced by the local contact of certain cadaveric emanations; the post-mortem clerks of our hospitals often suffer when newly appointed, the poison acting at first as a direct irritant upon the follicles to which it is applied. They are far more common in some years than in others. In persons who are predisposed to their formation any local irritation is apt to produce them, such as the friction caused by rowing, the application of a poultice, water dressing, strapping, or a blister. They may attack the integument of any part of the body, the palms of the hands and soles of the feet being apparent exceptions.

In the dense integument of the nape of the neck, buttock, and outside of the thighs, they are more chronic and painful than in the skin of looser texture. They are troublesome local affections, but seldom endanger life. In rare instances they are followed by septicæmia and death, but I have known this to occur only in one instance.

Treatment of boils.

Constitutional.

Diet.

TREATMENT.—The general treatment of boils must depend upon the condition of the body and the apparent cause of the complaint, any unwholesome habit being corrected and any evident want supplied. Under other circumstances the practice must be directed on general principles. The diet should be nutritious, but not too stimulating, exercise always short of fatigue should be allowed, and fresh air obtained when possible; the secretions should be looked to, and, when out of order, corrected, mild laxatives being often of use. When the skin is secreting unhealthily the Turkish bath or warm bath is of great benefit; alkalies or acids are to be given when the condition of the stomach needs them, alkalies and bitters being often of great use.

Quinine.

When debility exists, quinine is invaluable, and in London or large towns its combination with iron is wanted. When diabetes is present, the "feeding" treatment is probably the best. Dr. Jackson, of the United States, gives twelve to sixteen grains of quinine a day, increasing the dose daily until its special effects are produced, and then decreasing it. He continues the treatment for a month. Yeast in doses of a table-spoonful, taken fasting three times a day, at times appears to have a rapidly marked beneficial effect, although upon what principle it is difficult to say.

Yeast as a medicine.

Local treatment.

The local treatment must be directed much by the local symptoms, it being, as a rule, a better practice to let the boil discharge itself or dry up than to lance it. In the early stage of the papular or follicular form of boil the free application of alcohol, spirit of camphor, the nitrate of silver, liquor potassæ, or iodine tincture, is often followed by its disappearance; but in the other kind all such applications are worse than useless, the abortive treatment in them being unsuccessful.

Incision when great tension.

When the pain is great, from the tension of the part, and the areola of inflammation is spreading, relief may generally be given by lancing the boil, and when the slough is slow in separating, the introduction into the opening of a point of potassa fusa is followed by the rapid cleansing of the wound and its granulation. Poultices may be applied for a limited period during the sloughing stage, but not for long, as they often encourage the appearance of others; water dressing is generally preferable. When the local inflammation is not great, the plan of covering the boil with a piece of plaster, with a hole in the centre, is a very good one. At times, painting the areola with collodion or colloid styptic answers well. When boils succeed one another *seriatim*, without any definite cause, change of air is most successful.

The Delhi boil.

The Delhi boil and Mooltan sore are probably identical diseases, both, according to Messrs. Alcock and Fleming, of the Indian Army ('Army Med. Rep.,' 1868), being local diseases, due to the presence of some animal parasite, such as the ova of distomata, which are found in foul water. Professor Aitken supports this view. Dr. John Harley ('Med. Times,' Nov. 19, 1870) tells us that persons affected with the parasitic hæmaturia of South Africa often suffer from boils and sores similar to the Delhi sores.

On carbuncle.

Carbuncle.

This is a far more serious affection than a boil, for it is almost always met with in the feeble and cachectic subject, and generally in men, rich or poor, over forty-five. It is very frequently associated with diabetes, and gouty people are particularly prone to its attack.

It generally occurs singly, and is slow in its progress, the inflammation in the skin and cellular tissue beneath spreading as a brawny inflammatory effusion, with no defined border. The redness of skin is rarely vivid, more frequently livid; at times the local pain is severe, and constitutional depression very great. The sloughs separate slowly, many openings, as of many boils, allowing them to escape, and the whole skin at times separating as an ash-coloured layer, leaving an irregular cavity undermining the neighbouring tissues. The favorite seats of carbuncle are the skin and subcutaneous tissue of the nape of the neck, back, and buttock; they occur, however, on the front of the body and the extremities, and at times on the lip or face. The disease is so slow in its progress as at times to occupy many weeks, one part going through its course as it spreads in another. The disease may destroy life by exhaustion, at times by pyæmia, the worst form of pyæmia being found with it; indeed, M. Labat ('Med.-Chir. Soc. Bordeaux,' 1868) believes pyæmia to be the most common cause of death in carbuncle. Rare cases have been recorded in which peritonitis was caused by the extension of the disease from the abdominal walls into the peritoneal cavity.

Situation.

Slow progress.

When the treatment by incision is adopted, life is too often shortened by loss of blood. As a general rule, however, carbuncle is not a fatal disease; its danger depends much upon its extent, and more upon the complications with which it is associated.

Treatment of carbuncle.

Incision deprecated.

Treatment.—In former days the one form of local treatment that every Surgeon followed was that of the crucial incision +, the knife being passed freely through the tissues to the base of the inflammatory effusion; the object of the incision was to give room for the slough to separate and come away. In modern times the value of this practice has been much questioned, for it was too often found to be followed by loss of blood, where blood was much needed; and it has been questioned whether the incision did much to hasten the progress of the case and the separation of the slough. It is still, however, a popular form of practice. I was taught it, and from observing its effects have long given it up, believing that it did little or no good, and was often followed by a harmful hæmorrhage.

Caustics preferred.

The treatment I prefer, and have followed for many years, has been that by caustic, and the more I see of it the better I like it. It has been strongly advocated in this country by Pritchard, and in America by Dr. Physic. It is applicable in the stage of the disease when the cellular tissue is brawny, and the early inflammation of the skin has subsided; it may be used before any openings in the skin are found, either as Pritchard advises, by rubbing the caustic potash freely in the centre of the carbuncle until an eschar is fully formed, or, which is preferable, by puncturing with a scalpel, and inserting the stick or a small piece the size of a pea; when the carbuncle is large, many punctures may be made, one to every surface of the dimensions of half-a-crown. Where openings exist, the Surgeon has only to insert the caustic and let it melt, either in stick, or, what is better, in pea-like masses, by means of dressing forceps, passing them well down into the subcutaneous tissue. By this practice the slough is certainly cast off more readily than when incisions are made or the case left to nature. No bleeding takes place, and very little pain beyond that at the time. A clean granulating wound soon takes the place of the sloughing one, and a rapid recovery ensues. With this treatment large carbuncles become soon healthy granulating wounds. The only care required is to prevent the caustic running over the sound skin. During this treatment a poultice may be applied, or some lotion, such as Condy's fluid, carbolic acid, or alcoholic lotion; a solution of opium applied to the part often giving relief to pain when severe. Tonics, good living, and fresh air, are also essential. The French surgeons prefer the use of the Vienna paste; by these means, unless the carbuncle is associated with some serious malady, such as diabetes or pyæmia, a good result may be looked for.

Sub-cutaneous incision. Compression.

The plan of making a subcutaneous incision has been ably advocated by Mr. French and M. Guérin, and that of compression by Messrs. O'Ferrall and M. H. Colles of Dublin ('Dub. Quart. Journ.,' 1864). The former plan I have tried, but have failed to find its advantage. The latter I have not employed, having been too well satisfied with the caustic treatment.

M. Gosselin strongly advocates the plan of making deep punctures into the carbuncle and evacuating them by means of compression.

Paget's mode of treatment.

The best thing, writes Paget ('Lancet,' 1869), you can do, if the carbuncle is small, is to cover it with emplastrum plumbi spread on leather, with a hole in the middle through which the pus can exude and the slough can come away. When the carbuncle is large he advises the common resin cerate, and over it a linseed-and-bread poultice, perfect cleanliness being observed during the sloughing process.

On facial carbuncle.

Facial carbuncle.

This has been often miscalled "malignant pustule." It was probably first described by a clever young Surgeon, Harvey Ludlow ('Med. Times and Gaz.,' Sept., 1852). It is generally found on the lip, the upper one being the more commonly involved, as an œdematous inflammatory swelling of the part, involving the nose and cheek, often preceded by some pustule or vesicle, and generally accompanied by them. It is almost always associated with severe pain. It ends, as most cases of carbuncle do, with sloughing, and at times the whole substance of the lip or cheek gives way. It is associated, like carbuncle, with great constitutional depression, and its special danger is thrombosis and phlebitis of the cerebral sinuses, the inflammation of the veins extending from the affected parts through the ophthalmic veins to the cavernous sinus. I have seen six cases of this affection, four of the upper and two of the lower lip, and all recovered; in only one did the disease extend beyond the lip. In all, the disease, as far as local treatment was concerned, was left to natural processes, cleanliness and fomentations being alone employed. Tonics and good diet were given. Quinine and iron, in full doses, seem the best. Paget advises quinine in sufficient doses to produce symptoms of cinchonism.

Treatment.

Reverdin's conclusions.

M. Reverdin, interne des hôpitaux, gives a very elaborate essay on this subject in the 'Archives Générales de Médecine,' 1870. At p. 162 of the August number he thus sums up his conclusions:

1. Anthrax and furuncle of the face present a special gravity.

2. This gravity is due to the ready complication with phlebitis.

3. The facial phlebitis is attended with death, either by extension to the sinuses of the dura mater, or by becoming the source of purulent infection.

4. Of anthrax of the face, that of the lips is more frequently complicated with phlebitis than the others. This may be explained by the peculiar texture of the lips.

5. Anthrax of the lips has nothing in common with malignant pustule.

6. The involving of the orbit in the phlebitis, as demonstrated by exophthalmia, shows almost for certain the implication of the sinus.

7. Incision, speedily and extensively performed, seems to be the best means of preventing and sometimes arresting the phlebitic complication.

On malignant pustule.

Malignant pustule, or charbon, is a disease of which I have had but slight personal experience. M. Bourgeois, in a work entitled 'La Pustule maligne et Œdème malin' (Paris, 1861), has given a full description of it. He tells us it is derived from an animal poison, and that it is communicated to man by direct contact with the body of a diseased animal, or with any material that has been in contact with the disease. It is mostly found on the exposed parts of man, such as the hands and face, and begins as a small, red, inflamed and itching spot, which in twelve or fifteen hours vesiculates, the skin beneath the vesicle appearing as a dry brown or black slough. In the course of the second day another crop of vesicles appears around the original seat of the disease, which run the same course. About this time the seat of the original disease has become more swollen, appearing as a defined lump ("bouton"), the parts around being œdematous, and the whole subsequently sloughing. In this stage of the disease there is little pain, the slough is always *dry, and there is no pus,* the sloughing spreading from the skin down to the subcutaneous tissue instead of as in carbuncle from the latter to the former.

Mode of progress.

Malignant pustule is also rapid in its progress, four to nine days seeing its end. It is usually ushered in with rigors and symptoms of depression, followed by vomiting and great depression, often cold sweats and delirium, the patient dying from the depressing influence of the animal poison before its local effects have had time to work. In young subjects the prospects of recovery are greater than in the old, and when the hands are involved the chance is better than when the head is affected.

Treatment.

TREATMENT.—The disease being in its nature local, local treatment is to be preferred, and Bourgeois tells us that the free application of some caustic, such as the potassa fusa, so as to destroy fully the eschar and primary vesicles in their early stage, is the best treatment; and in more advanced cases the excision of the slough and the free use of the same caustic is to be recommended. Tonics, diffusible stimulants, and such means as are usually employed to guard against the tendency to death, are of great value.

Perforating ulcer of the foot.

On perforating ulcer of foot.

This affection was so called by Vesigné of Abbeville in 1850; it is an affection which Mr. Hancock has brought prominently before us in an able paper published in the 'Brit. Med. Journ.,' June 26th, 1869, although Cloquet, Boyer, and Nélaton, of Paris, have described it.

Nélaton's description.

Nélaton describes it "as commencing with phlyctæna in the pad of the foot. The epidermis is raised by a small quantity of purulent serum. Others describe it as commencing as a flat corn, which ulcerates. When this is opened, the subjacent dermis appears of a rose colour, and when touched is highly sensitive. This state may continue for some time, when the dermis in its turn gradually ulcerates, and a small fistulous opening is established in the subcutaneous cellular tissue, which will not heal, but continues to discharge serum slightly tinged with pus. If after five or six weeks the sinus is examined by a probe, the subjacent bone is felt rough and necrosed, and a sequestrum subsequently forms."

The disease is probably hereditary; it is most obstinate in its character, generally spreading over years; it is, however, mostly local, and confined to the anterior portion of the foot. Medicine has little power over it, although Fowler's solution has been much vaunted for its cure, but with insufficient evidence, and, as far as facts can guide us, it appears Hancock's conclusion is the only right one, and that is that in the first instance, when dead bone exists, it should be removed. "But if, notwithstanding, the disease returns, there can no longer be a question that when once perforating ulcer of the sole of the foot is established and recognised, it is better at once to remove the whole of the metatarsal bones, either by Chopart's, Syme's, or Pirogoff's amputation."

Treatment.

These cases are not to be confused with the suppurating bursæ or bunions found in feet deformed from short or tight boots.

The fungus disease of India.

Mycetoma or the fungus disease of India has been described by Dr. Carter, of Bombay, in the 'Trans. of the Med. and Phys. Soc.,' Bombay, 1861, and in a memoir, published by Churchill, 1874, and is supposed by him to be due to the presence of a fungus. Other authors have thrown doubt upon this point, although the disease is well recognised. Berkeley observes, however, that the bodies found in the disease "so nearly simulate fungous growths, that it is difficult to get rid of the notion that they are not really vegetable growths." ('Intellect. Observ.,' 1863.) The disease is more frequent in men than women; it affects all castes, rich and poor, but it has never attacked a European.

The disease is a chronic one, and affects most commonly the foot, sometimes the hand, and rarely other parts of the body. It is very slow in its progress, and has no tendency to get well if left alone. It usually begins on the plantar surface of the foot or the palmar of the hand, the earliest symptoms being an induration in or under the skin; this induration subsequently softens down, a bleb forms over the spot, and bursts, leaving a sinuous opening, from which exudes a thin, sanious, sero-purulent discharge. As the disease progresses other indurations, followed by sinuses, form, till the foot or hand becomes one indurated diseased mass, riddled with holes the orifices of sinuses which may or may not lead to bone; in extreme cases the bones are tunnelled. These sinuses discharge freely a putrid sero-purulent fluid, containing "fungus particles." These are of two kinds, each kind, according to Dr. Carter, marking a variety of the disease. One kind, the dark or dark brown, is globular or ovoid in form, hard and friable in consistence, and of the size of a pin's head to that of a bullet. The other is pale or yellowish in colour, soft and cheesy in consistence, and of the size of a minute speck or pea. Dr. Carter and others believe that excision or amputation of the affected part is the only sound practice to be adopted.

On warts.

Warts.

These are growths of the papillæ of the skin, the papillæ being usually elongated and their epithelial covering thickened. They are common on the hands and other parts of the body of the young; they are more rare in the adult. When on exposed parts of the body, they assume a horny hardness; when surrounded with moisture or the secretion of the skin, they are soft and more sensitive.

Flat warts. Pedunculated warts.

The flat wart is called *verruca simplex*, the pedunculated *verruca digitata;* and these are said to be more common in the scalp. I have seen them on the neck, orifice of the nose, mouth, eyes, ears, and anus, also on the prepuce and labia. I have seen some on the tongue. They occur at times beneath the nails and are very painful—*subungual.* The best crop of warts I ever saw was around the anus of a boy.

The flat warts occasionally come and go in a way which is not to be accounted for; as a rule, they are, however, persistent. They rarely last into adult life. When they do they seldom grow or give trouble. In exceptional cases, under some local irritation, they may increase and assume more the character of an epithelial cancer. When on the face this change is peculiarly liable to occur. Not long ago I destroyed an epithelial cancer by the ala of the nose, the size of a florin, that had suddenly appeared in a wart that had existed for sixty years, nearly all the patient's life, and I have removed from the lip of a man a cancer that had grown from a wart which had existed as long as he could remember.

Venereal warts.

Venereal warts are very abundant, whether they grow from the glans penis or prepuce of the male or labia of the female. They are pedunculated, moist, and highly vascular. They are clearly contagious. Warts, however, occur at times in these parts without any venereal contact.

Treatment of warts.

Treatment.—Some powerful alkali, such as ammonia, to dissolve the cuticle, and the subsequent application of the glacial acetic acid, nitric acid, or acid nitrate of mercury, to destroy the papillæ, is the best plan to get rid of the harder or flat warts. Lunar caustic is an unsatisfactory and tedious remedy. Pedunculated *dry* warts should be cut off with the knife or scissors, and the *moist* may be treated in the same way when not too extensive. When extensive, they may be made to dry up by the application of some powder, such as the oxide of zinc, or even starch. Powdered fresh savine is a good application, Mr. T. Smith recommending it to be mixed with the powdered diacetate of copper. The perchloride of iron in tincture is also good. Venereal warts and others, when extensive, may be readily destroyed by means of the galvanic cautery, the patient being under chloroform. At times excision is the best practice. In the large masses that are found on the genital organs of women, of venereal origin, nothing but the removal of the whole with the labium can be entertained; when the écraseur or the galvanic cautery cannot be obtained, the ordinary wire one may be used. The hæmorrhage from these venereal warts is generally severe; and the Surgeon should never attempt to remove them, when extensive, by excision, without having at hand some good styptic, such as the solution of the perchloride of iron, matico, alum, dry and in solution, or the cautery in one of its forms.

Moles.

On moles.

Using the word in the broad sense to include small spots of discoloured skin, and cutaneous connective tissue tumours with pigment, with or without unnatural growth of hair or skin glands, they are very common; few people are without one or more upon the surface of the body, many have them in numbers. I have seen a woman studded all over with hairy moles, the hairs being in some half an inch long and bristly. They are generally congenital, but at times put in an appearance later in life; they are rarely of any greater importance than the disfigurement they produce; occasionally, however, they degenerate or become the seat of a cancerous disease, the melanotic cancer having frequently its origin in such congenital spots. This clinical fact, which is now fairly recognised, is an important one, and renders it expedient for the Surgeon to excise any mole that has a tendency to grow or to become indurated in middle life; for the melanotic is a soft cancer, as a rule, and, when it has once appeared, is prone to spread and multiply rapidly. Many of the most virulent forms of multiple cancer the Surgeon sees have their origin in moles.

May be the seat of cancer.

On corns.

Corns.

These are thickened cuticle, the result of *occasional* pressure, whether on the toes or feet, from tight or hard boots; or on the hands, from the mechanical irritation of tools, &c. It should be remembered that they are the result of occasional, and not constant pressure, the latter causing atrophy and absorption. Not only, wrote Hunter, "the cuticle thickens, but the parts underneath, and a sacculus (bursa) is often formed at the root of the great toe, between the cutis and ligaments of the joint, to guard the ligaments below." This bursa forms under all corns when the pressure is not removed, in all old and neglected cases. A corn, when newly formed, can, by maceration, be elevated from its position as thickened cuticle only, the cutis being unaffected; but in old corns the cutis appears to atrophy, and the papillæ to disappear. Such corns, writes Mr. T. Smith ('Holmes's Syst.,' vol. v), "may be found based upon the fibrous tissue of the sheaths of the extensor tendons of the toes, all intermediate structures having been absorbed." When a bursa has formed it may inflame or suppurate, and give rise to troublesome conditions, such as will be described under "bunion."

Soft and hard corns.

A corn is called "soft" when it forms between the toes. It is far more painful and sensitive than the "hard" corn; it grows also more rapidly, these points being probably determined by its greater moisture.

Treatment of corns.

TREATMENT.—Remove the cause and the disease will disappear. This is a truism which applies to corns of all forms, when acted upon early. Boots which are too loose are as injurious as those which are too tight; where one presses the other rubs, and the result is the same. A well-fitting boot, with a straight inner border and broad top, is the best. To remove the cuticle nothing equals warm water; after soaking the part in it for some time, or keeping the corn covered for a night or more with water dressing and oiled silk, the whole may be carefully peeled off by means of a knife. After the removal of the corn the skin should be protected by a piece of soap-plaster spread on leather. The application of nitrate of silver has been recommended. I have known it produce great pain, and, when applied to an inflamed corn, much harm; indeed, in one case sloughing of part of the integuments covering the little toe; in old people it is dangerous. The application of the glacial acetic acid is to be preferred. When suppuration takes place beneath a corn it should be relieved by a puncture as soon as possible, and water-dressing applied. Bursal swellings are to be treated as bunions. Soft corns are best treated by taking away pressure by means of the introduction between the toes of cotton wool or undressed wool, and the use of some dry powder, such as the oxide of zinc; the corn then soon becomes a dry one, and may be eradicated. The acetic acid is a good application in obstinate cases.

Bunions.

On bunions.

Mode of formation.

When from excessive or long-continued pressure a bursa forms over one of the tarsal or metatarsal articulations, a "bunion" is said to be present; the most common seat being the metatarsal joint of the great or little toe. This fact is to be explained by the evil tendency which boots, as generally made, have to draw the toes together towards the central line of the foot. In this way the central axis of the undeformed great toe is altered from the normal line, which runs parallel with the metatarsal bone, through the centre of the heel, to an abnormal one, in which the great toe itself, looking outwards, forms an angle pointing inwards with the metatarsal bone at the joint, and the axis of the toe falls far within the normal one of the foot.

Key's opinion.

Aston Key attributed this deformity more to excessive weight received on a weak tarsus and metatarsus from over-standing; the great toe being gradually forced outwards by the oblique bearing of the foot on its inner plantar surface, when the arch of the foot has given and the foot become flat. When the boots are too short a like change occurs; the foot becomes compressed longitudinally; the arch of the tarsus becomes increased; the toes are drawn up, even to form angles with the metatarsal bones, the great toe suffering the most. Protective bursæ form over the projecting bones, to save the joints from injury, and at times over the dorsum itself. Under extreme conditions the bursa may inflame and suppurate, giving rise to obstinate and troublesome sores; in still more extreme or neglected cases the joint of the great toe may be involved, ending in the destruction of the joint, with or without exfoliation of bone.

Treatment of bunion.

Preventive.

TREATMENT.—When the nature of a bunion is understood, the principles of its treatment become clear. Preventive treatment is the best, and that consists in maintaining the natural condition of the foot—in young children, and in girls especially, by guarding against the flattening of the foot from over-standing or walking during the period of growth, by guarding against altering the axis of the great toe, by keeping the inner line of the boot straight, and in no way by too short boots cramping the foot longitudinally.

Restore natural position of the toes.

When a bunion exists the only consistent treatment is the one that tends to restore the misplaced toes to their natural position; when the great toe is involved, either by Key's plan of having a separate compartment made in the boot, so constructed as to keep it in a straight line with the foot, or by the bunion spring, as recently invented by Mr. Miller, of Leicester Square. Even in severe cases this practice may be successful, and in the old and confirmed cases the same is to be adopted; palliative treatment at times is alone practicable.

The common plan, wrote Key in 1836 ('Guy's Hosp. Rep.'), "resorted to for the relief of bunion palliates the evil, in some degree, by removing the pain, and taking off the pressure; but it does not go to the root of the evil. The plasters on thick soft leather are agreeable to a painful bunion by keeping the skin in a pliant state, and by protecting the part from pressure;" but they do not cure the disease.

Removal of pressure.

Under all circumstances pressure is to be removed; nothing like a tight boot is to be thought of, a wide and easy one being worn. To the inflamed bunion water-dressing is the best application. Should suppuration take place, an early incision into the bursa should be made. In old people, however, some caution is called for in carrying out this practice, for in such, where from diseased arteries or other causes the circulation is feeble, gangrene of the part or a troublesome suppuration may take place. When suppurating sores exist, they may in the old require stimulating applications; in the middle-aged, the bursa may be laid open, and allowed to granulate, or be excised. In the early stage of a bunion the mechanical means suggested may be aided by the local application of a small blister, and Mr. Thomas Smith speaks highly of the local use of the biniodide of mercury, ten grains to an ounce. ('Holmes's Syst.,' vol. v, ed. 2nd.)

In the last stage, when the joint is destroyed, the case may have to be treated by excision of the parts or even amputation.

In-grown toe-nail.

On in-grown toe-nail.

Causes.

This is a troublesome and painful affection; it is more commonly met with on the outer side of the great toe-nail than on the inner, but it may occur in both places; it is usually caused by external pressure upon the soft parts, the movable soft parts being pressed upon the immovable nail. As often as not, it is due to the collection of cuticle beneath the edge of the nail, this cuticle acting as a foreign body, and by its pressure causing ulceration. Ulceration having been once set up, the healing process is prevented by the presence of this cuticle, the pressure of the edge of the nail, and the soft parts covering it in. Fungous granulations, consequently, frequently form, and copious discharge takes place, the affection being attended with severe pain.

Fungous granulations.

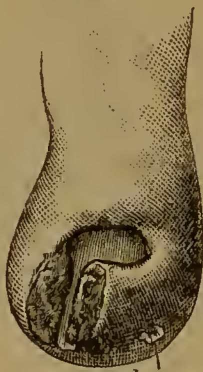
Treatment.

In slight cases.

Treatment.—The disease being the result of pressure applied from without, in the shape of tight boots, or from within, in the form of indurated cuticle beneath the nail, the Surgeon's main object in the treatment is to take away the exciting cause; and, when the collection of cuticle exists, by the careful introduction of a probe beneath the nail, to procure the evulsion of the foreign body. In early examples of the disease this treatment is often sufficient. When external pressure has been the cause, and ulceration exists, the soft parts may be carefully pressed away from the sharp edge of the nail, against which they are pressed, by carefully introducing beneath the overhanging integument a small roll of lint, pressing it well down to the bottom of the sore, and fixing it in position by means of strapping, which should be so applied as to draw the soft parts away from the nail. This treatment, by removing all pressure from the sore, is, as a rule, successful; when the fungous granulations are excessive, and discharge profuse, the free use of alum, oxide of zinc, lunar caustic, or more particularly the powdered nitrate of lead before the application of the lint, is of great value. After one or two applications of lint, in the manner thus described, the soft parts will have been so pressed to one side as to expose the edge of the nail with the surface of the sore; and under these circumstances the lint, or a piece of thin sheet lead or tinfoil, may be carefully introduced beneath the edge of the nail, and the dressings renewed. Under this treatment a rapid cure readily takes place, and if no external pressure be applied, and the nail is allowed to grow up in its normal square form, no recurrence will occur. In severe cases, where the soft parts so overhang the nail as to be unaffected by the means here suggested, or in which the nail perforates the soft parts (Fig. 43), the best practice is to excise, by means of a scalpel, the overhanging integument. In this way the ulcer is exposed, and all external pressure at once removed, the sore, as it heals, having a tendency to contract, and thus considerably to diminish the chance of a repetition of the affection.

In severe cases.

FIG. 43.



protruding nail

Removal of portion of nail.

When the ulcer has spread far under the nail, it may be expedient to remove a portion of the latter to allow of cicatrization; but, in a general way, to remove half the nail, to take away a V piece from its centre, to scrape or notch it, are only temporising measures. They may succeed for a time, and allow the sore to heal, but it will recur, in all its severity, as soon as nature has restored the parts which the Surgeon has injured.

To cut the corner off the nail, under the idea that it is the offending body, is a futile proceeding; it may for the moment appear to be of use, but, in the long run, it is injurious; indeed, the nail should be left square, as nature made it, and care should be taken to see that the soft parts by no external pressure are pressed over its edge.

On onychia maligna. Generally in children.

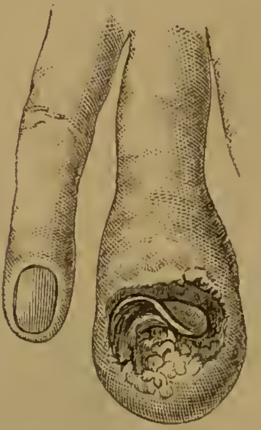
Onychia maligna is a disease of the nail matrix, and a far more severe and obstinate affection than the last. It is found most commonly in unhealthy children, and is, as a rule, started by some local injury, such as a squeeze. It commences as a swelling of the end of the toe or finger, with the other external signs of inflammation—redness, heat, and pain; these symptoms are soon followed by the exudation from beneath the nail of a serous fluid, which is often fœtid; the nail itself loosens, sometimes falls off, or either flattens out or curls up at its edges (Fig. 44). When this occurs, a foul ulcer is visible beneath. In extreme cases the affected part assumes a flattened bulbous form, and looks as incurable as any local affection can well do, and, in rare instances, the disease involves the last phalangeal joint or bone. It is never found in other than feeble and cachectic children. The worst case I have seen of this disease occurred in a child, æt. 10, in whom the fingers and thumbs of both hands were involved; it had existed for years.

Treatment.

TREATMENT.—In favorable and not extreme examples of this affection tonics internally and water-dressing externally suffice to bring about a cure; but in others more active local treatment is called for, such as the application of some mercurial lotion, as black-wash, or Abernethy's lotion, formed of the liquor potassæ arsenitis ʒij to ℥j of water, or the red oxide of mercury ointment. In the case I have just alluded to all this treatment failed, even after the evulsion of the nails—a plan of treatment that should always be adopted in obstinate cases

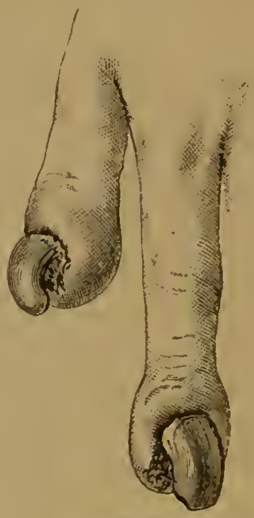
—and a cure was at last secured by making a clean shave of the dorsal aspect of the extreme phalanx, taking away nail and soft parts. This practice was adopted only after the disease had existed for five or six years, and had resisted every form of treatment, even the repeated evulsion of the nails; the pain being agonising and demanding surgical interference. Fig. 45 was taken from one of the fingers of this patient. Professor Vanzetti, of Padua, strongly advocates the application of the powdered nitrate of lead to the ulcer, and Mr. W. MacCormac advocates a like practice. My own experience of its value justifies me in strongly recommending it. In this practice no removal or cutting away of the nail is called for. Constitutional treatment is always needed, with tonic regimen.

Fig. 44.



Acute onychia.

Fig. 45.



Chronic onychia.

This disease is said at times to have a syphilitic origin. I have been unable to satisfy myself as to the truth of this point. When associated with other symptoms of syphilis, however, it will be wise to adopt specific treatment.

Other diseases of the nails.

Arrest of growth of nails.

Ridged nails.

Under the influence of some acute diseases the nails cease to grow, and the arrest becomes manifest, as convalescence appears, by a transverse groove, which represents the period of arrest of growth, while its width denotes the duration. As a result of hereditary syphilis Mr. Hutchinson has shown that the nails may become completely ridged, and even in acquired syphilis, Hutchinson, Wilks, and Fagge have fairly proved that the nails may become narrow, thick, ill-formed bodies, or concave, rough, and black.

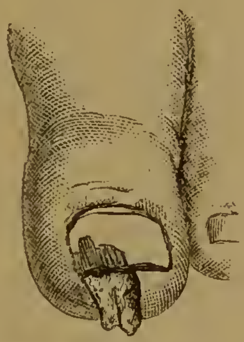
Psoriasis of nails.

Psoriasis affects the nails somewhat in the same way, the nail thickening and splitting vertically, and in *favus*, Fagge has shown that the part may become thickened, and of a yellow colour, from the interstitial deposit of the parasitic disease. Wilks, in the 'Lancet' for 1868, and Fagge, in 'Guy's Hosp. Rep.,' 1869-70, wrote fully on these points.

Clubbed nails.

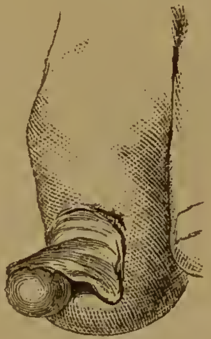
At times the nails become soft and, in feeble subjects, very convex. This condition is said to be common in phthisical subjects, but in surgical disease I have often observed the same condition to appear during illness, and disappear as strength returned. I look upon it only as a mark of feeble power.

FIG. 46.



Horny growth from beneath nail.

FIG. 47.



Ungual exostosis.

Horny growths and ungual exostosis.

Horny growths occasionally spring up beneath the nail, as seen in Fig. 46, and *ungual exostosis* very frequently appears—that is, a bony outgrowth from the extreme phalanx of the great toe, as seen in Fig. 47. Both require excision.

ELEPHANTIASIS.

Elephantiasis Græcorum.

This term has been applied to two very different diseases, the *Elephantiasis Græcorum, or true leprosy,* and the *Elephantiasis Arabum, or Cochin or Barbadoes leg.* The former disease is probably a constitutional one; it appears as a tubercular affection of the skin, more especially of the face, attended with some loss of sensation. It is usually ushered in with slight febrile disturbance and local œdema. As the disease advances, the skin thickens and the tubercles multiply; the disease spreads, and involves the tongue, mouth, nose, eyes, and even larynx and lungs. In extreme cases ulceration exists, and disease of the bones, the subjects of the affection dying from exhaustion, if not of suffocation. This disease is, happily, rare in this country, although it does occasionally occur; in Norway, in the Mediterranean, and in the Indies, it is, however, common. Dr. Webster, in the 'Med.-Chir. Trans.' for 1854, and Mr. Day, in the 'Madras Quart. Journal' for 1860, give valuable information upon this subject, and Dr. Carter, in the 'Trans. Med. and Phys. Society of Bombay,' vol. viii, new series, enters fully into its pathology.

Gurjun oil.

The disease has been regarded as incurable, although, since the introduction of the Gurjun, or wood oil, by Dr. Dowgall in 1873, better results of its treatment may be looked for. The oil is used as an external application, made into an emulsion with lime water, in the proportion of one part to three, being well rubbed in twice a day for two hours at a time. It is also to be taken internally in two-drachm doses mixed with the same quantity of lime water twice a day. By this treatment the tubercles are said to soften down; and in their place watery blebs form, which burst and discharge a clear serous fluid, the induration gradually subsiding. The oil internally is a diuretic and purgative.

Elephantiasis Arabum.

To the Surgeon the second form of elephantiasis, or the *Elephantiasis Arabum*, is of the greatest interest. It is possibly a local affection, and is quite distinct from the true leprosy. It appears generally in one or other of the lower extremities, or in the male or female genital organs; it shows itself as a general infiltration into the skin and subcutaneous tissue of an organisable material, whereby the integument becomes hypertrophied and greatly thickened. In advanced disease the skin falls into great folds, and between these, fissures form, which subsequently pass into oozing ulcers. At times the foot and leg become the seat of extensive ulceration, which rarely cicatrises.

The affection generally begins with some febrile attack, and the affected part becomes the seat of an erythematous redness and swelling, which subsides, again to recur, each attack leaving some extra thickening behind it. I have watched this in one case very clearly, and have no doubt that the erythema had some distinct relation to the disease.

Dr. Wise, of Calcutta, in 1835, looked upon the disease as one of the venous system, and as inflammatory. Dr. Carnochan, of New York, believes it to be associated with an enlargement of the arterial trunks of the part, and upon this based his practice of tying the main artery of the limb, and thus of starving the disease. Mr. Day, in the paper already alluded to, regards it as consecutive to malarious fever, and Mr. Dalton ('Lancet,' 1846) looks upon it as a constitutional disease, like the leprosy.

Treatment.

From twelve or more cases I have seen I do not believe in the theory of its being due to disease of the venous system, for pathological evidence is wanting to support the view, but I am disposed to regard it as a true hypertrophy from excess of vascular supply. This view is supported by the clinical fact that in some cases, if not in all, where the main artery of the limb is ligatured, and the vascular supply to the disease cut off, a recovery takes place.

Carnochan, of New York, was the first surgeon to perform this operation (in January, 1851), and the success he met with, as published in a memoir on the subject in 1858, induced me to follow his example

FIG. 48.

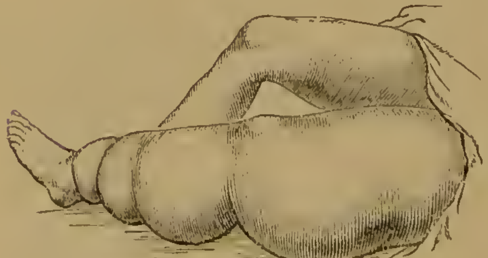
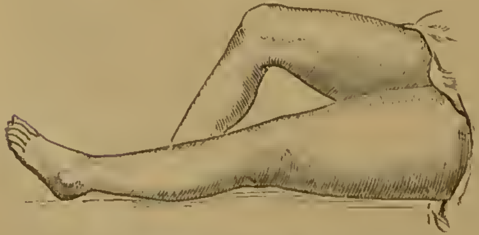


FIG. 48A.



Case of elephantiasis Arabum before and after the application of a ligature to the femoral artery.

Example.

in 1865. My case in all its details was published in the 'Med.-Chir. Trans.,' 1866, and the benefit of the operation was most striking. It was in a Welsh girl, æt. 25; the disease had been of two years' standing, and was spreading. The thigh of the affected limb (Fig. 48) measured twenty-seven inches round, and the leg nearly twenty-three, the affected leg being nine inches in circumference larger than the sound one, and the thigh seven. Five weeks after the ligature of the external iliac artery the calf of the affected limb measured seven inches less than it did at the time of operation, and when she left the hospital the limb appeared as in Fig. 48A. The rapid disappearance of the thickened tissue was very remarkable. Since the operation the girl has gone on well; she is companion to a lady, and can now walk ten or twelve miles. The limb becomes slightly œdematous only on over-exertion.

I have performed the same operation twice since, but not with an equal success. I ligatured the femoral artery of a man who had the whole limb involved, the thigh being only slightly so, and for a time everything promised to be as successful as in the case recorded; but an attack of erythema came on, followed by renewed swelling of the extremity, and never disappeared. In this case the size of the superficial femoral artery was extraordinary, the loop of the ligature when it came away being capable of admitting a No. 12 catheter. The vessel seemed to be nearly the diameter of my finger and was very thick.

The operation, however, appears to be worthy of repetition, and deserves more extensive trial. The vessel should be ligatured well above the disease. I may add that Butcher in 1863 and Alcock in 1866 had successful cases; but Fayrer, late of Calcutta, and Buchanan, of Glasgow, have not met with good results.

Pressure.

When surgical interference of this kind is not applicable, pressure should be employed. All other treatment, medical or surgical, seems useless.

Tumours of the umbilicus.

Pedunculated umbilical growths.

Pedunculated outgrowths from the umbilicus are not very uncommon, they are always found in children, and are composed of simple granulation tissue; indeed, it seems probable that they are really due to excess of granulation growth from the point at which the umbilical cord separated. They sometimes attain a large size, and have at times a slight central canal or orifice, but the former never travels far. I have seen one the size of the last joint of my little finger. They are readily cured by the application of a ligature to their bases.

Patent urachus.

These tumours must not be confounded with a condition that is occasionally met with—the presence of a fleshy outgrowth, not unlike a glans penis, through which a canal really passes into the bladder, the canal being clearly an open urachus. I have seen but one such case and have recorded it in my Lettsomian lectures on the surgical diseases of children, 1863. I was not permitted to do anything to it, although I wanted to cauterise the surface of the canal, and thus cause its contraction and closure.

Ulcerated hernial protrusion.

I have also seen a large hernial protrusion appear at the umbilicus, with the whole surface ulcerated; in it there were some solid contents, which I took to be the liver. It subsequently completely cicatrised and a good recovery ensued. The drawing of this case is in the Guy's Hospital Museum.

Sebaceous deposits.

Sebaceous tumours are met with at the umbilicus, as well as accumulations of sebaceous matter in dirty people. I have turned out large masses of such indurated secretion from the cup-like depression.

Cancerous, warty and syphilitic tumours.

Cancerous tumours, &c., may also exist there, as well as simple warty growths and syphilitic condylomata.

ON PARASITES.

Guinea-worm.

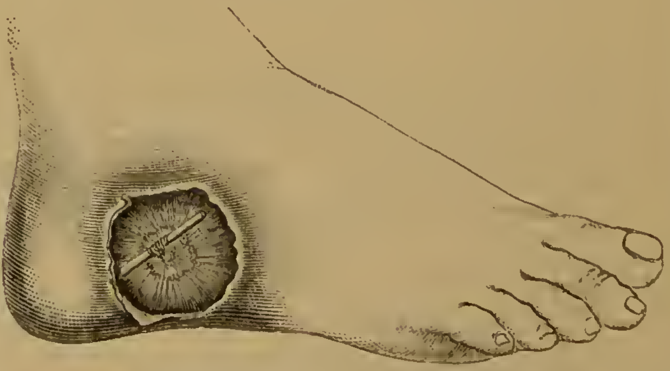
Guinea-worm.—The *Dracunculus* or *Filaria medinensis* is one of the most troublesome parasites known in Africa, Asia, India, and tropical America. In Europe it is only occasionally met with in those who have visited the above districts.

The mature worm varies in length from two to six feet. It is cylindrical in form and white in colour; it has a smooth surface, and is tough and elastic; its mouth appears as a circular orifice; it has no anus. How the worm enters the body is unknown, although it is clear that it enters from without, and probably through the skin of some part that has been in contact with water, for it is more common in the feet than in other parts of the body, although the Madras water-carriers are said to have these worms in the back. At any rate the worm gets into the subcutaneous areolar tissue, where it rests. Busk tells us that it does so usually for about twelve months, but it may be eighteen; and when mature, and the time has come for the discharge of the embryos with which it is filled, it makes its presence known, it bores the skin, protrudes its head under the cuticle, raises a bleb, and comes out bodily, discharging its young filariæ externally.

Early symptoms.

The first manifestation of the disease is usually a circular bleb, as represented in Fig. 49, although it often happens that pain and stiffness of the affected part has been complained of for some little time previously. The bleb contains sero-purulent fluid, and the Surgeon, in order to find the worm, should cut the raised cuticle off. "There will then be seen protruding from a little hole in the centre of the denuded cutis one or more inches of the worm, of the size and colour of vermicelli or of a wax match. The Surgeon now makes a small quill-like roll of adhesive plaster, rolls the worm round it, and gently draws as much as will come without risk of breaking; and this is repeated

Fig. 49.



Guinea-worm bleb just cut off. Dr. Druitt, 'Med. Times and Gaz.,' Jan. 3, 1874.

Treatment.

day after day, till at last the tail, which ends in a small hook, comes wriggling out, and the case is at an end." (Druitt, 'Med. Times and Gaz.,' Jan. 3, 1874.) Under these circumstances a rapid cure may take place. Should the worm break, a subcutaneous abscess is almost sure to form higher up; and when this is opened a loop of the worm can most likely be got out on a probe, and so be extracted as before.

At times no bleb forms, but a subcutaneous abscess. In exceptional cases more than one worm may exist. Druitt quotes a case in which nineteen had been extracted.

Considerable constitutional disturbance often attends these local changes.

Sand-flea.

Chigoe, Chigger, or Gigger, or Sand-flea.—This is found in the West Indies and in South America, but the impregnated female only infects man. It makes its way beneath the nails or between the toes by means of its long proboscis, and, having gained an entrance, rapidly increases to a white globular vesicle the size of a pea. Some local irritation attends its presence. To prevent trouble, the insect should be carefully turned out of its bed by dilating the orifice through which it entered with a needle, care being observed not to rupture the globular vesicle which contains the ova, for these escape into the cellular tissue, and are often followed by tedious suppuration and ulceration.

Hydatid.

The echinococcus or hydatid, the larva of the tænia echinococcus, is a common entozoon in the human subject; it may exist as a microscopical object, or as a cyst of many inches in diameter. It has highly elastic laminated walls, lined with a granular layer; it is usually enclosed in the parts of the body infected by it in a distinct capsule, formed by exudation into and the consolidation of the surrounding tissue. It contains a clear, watery, non-albuminous fluid, in which at times float some tænia heads or scolices, the so-called echinococci, or in which are found the booklets which surround the head.

These hydatids are met with in any part of the cellular tissue of the body—in the lungs, liver, abdominal cavity, pelvis, and even in the bones—a specimen existing at Guy's in which the spinal column was so affected. I have seen them turned out of the breast, tongue, thyroid gland, pelvis, vagina, uterus, and bladder. I have removed a cyst containing them from the muscles of the neck, axilla, and thigh; and have treated many also in the liver.

Symptoms negative.

At times an acephalocyst contains many secondary cysts; I removed a basinful from one occupying the pelvis ('Path. Soc. Trans.,' vol. xvii); they were of all sizes. Hydatid tumours are to be recognised by negative symptoms; they appear as tense, globular, elastic swellings in a part, and give rise only to such symptoms as are to be explained mechanically by their presence.

Treatment.

Treatment.—This must vary with the position, size, and growth of the hydatid tumours. When the parasite occupies some position in the body outside one of its great cavities, and it can be turned out of its bed by means of a free cut into its capsule, no better treatment is wanted. When it occupies one of the abdominal viscera, or one of the serous cavities, it should be left alone, unless from its size it interferes with important functions or threatens life, but this point will be discussed in another page.

Cysticercus cellulosæ.

The cysticercus cellulosæ, the cystic scolex of the common tapeworm, is found in man, and is said to be the common parasite of the "measly pig." It has a quadrangular head, short neck, and cylindrical vesicular body; its head is surrounded with characteristic booklets. It is found more particularly in the muscles and intermuscular tissue; it may affect the viscera as the former hydatid, and is known to occur in the eye, brain, heart, &c. It is to be treated, when interference is called for, by an incision into the part and removal.

Trichiniasis will be considered in the chapter devoted to the affections of the muscles.

SURGERY OF THE LYMPHATIC SYSTEM.

CHAPTER V.

INFLAMMATION OF THE LYMPHATICS AND THEIR GLANDS.

On inflammation of the absorbents.

The absorbent glands, with their ducts, are liable to inflammation, "*adenitis*" or "*angeioleucitis*," and this action is probably the result of the absorption of some septic material. It is almost always associated with a wound, punctured or open, inflamed, suppurating, healing, or scabbing; with some point of irritation or suppuration, even a papule or pustule; with some centre from which morbific elements may be taken up. In what is called a simple wound the inflammation of the absorbents may be acute, but in poisoned wounds it is violent and diffused. The inflammation always follows the course of the absorbents, leading from the centre of absorption towards the glands, that is, towards the body; it never spreads backwards. When it has reached the glands the diseased action ceases to spread; that is, it expends its force upon the group of glands in which the absorbents naturally end, and does not extend through another series of absorbents to a second group. The morbific material is arrested in the glands, at least such is the usual course of the affection. When pyæmia follows or complicates the case it may be open to question whether the poisonous fluid circulating in the lymphatics has not been allowed to pass into the blood through its usual channels, that is, through the inflamed glands onwards, but it is at least as probable that the same septic material that poisoned the lymphatics and set up inflammation in the tubes and glands was taken directly into the blood through the venous channels, and thus gave rise to blood poisoning.

The glands acting as barriers.

Symptoms.

Absorbent inflammation usually manifests its presence in a definite way; pain in some of the glands and tenderness are generally early symptoms, and with these, or soon following, will be seen a band of redness, varying in diameter, leading from the wound or infecting centre towards the gland; this red line may be a continuous or an interrupted one; it may be a thin streak of redness or a broad stripe, and in some instances it so radiates into the surrounding tissues as to simulate erysipelas. The whole line of redness will be very painful, and with these local symptoms there will be some febrile disturbance, and probably the attack will have been ushered in with a rigor. It is to be noted that the red lines follow the course of the absorbents, and not of the veins.

May subside.

Under favorable circumstances and treatment these symptoms may subside, and the red line, with the swelling of the glands and cellular tissue around the inflamed parts, and the constitutional symptoms, will then disappear.

May suppurate.

May be complicated.

In less favorable examples suppuration will take place, it may be as a local or diffused suppuration of the affected glands and surrounding cellular tissue; it may be as a local abscess in the course of the lymphatics, or as a series of local abscesses. In extreme cases the suppuration may partake more of a diffused character, such as that already described as taking place in phlegmonous erysipelas.

With these local changes the constitutional symptoms will assume different features; the febrile disturbance will probably be great, but it may be marked by depression; rigors may repeat themselves at regular intervals, these rigors generally indicating some suppurative process. When typhoid symptoms appear with rigors and sweating, the case has clearly become one of blood poisoning or septicæmia.

The three classes explained.

There are thus three different classes of cases:

The simple, terminating in resolution; the more severe, ending in local glandular or lymphatic suppuration; and the complicated, marked by diffused inflammation and suppuration, with general blood poisoning.

In the simple form the poisonous element is probably of a diluted or but slightly irritating nature; it is generally some altered secretion of a simple wound, due to external irritation. In the more complicated or severe forms the poisonous element is of a more active kind, and has been either introduced from without as by a distinct animal poison, a dissection wound, or bite of an animal; or generated from within, as seen in puerperal cases.

Inflammation of the absorbents, erysipelas, phlegmonous or otherwise, and septicæmia, are all closely connected.

The effects of inflammation of the absorbents.

The effects of inflammation of the absorbents are not, however, constant or alike in all cases. In some instances the glandular enlargement alone is to be recognised, with more or less extensive suppuration of the glands and their surrounding connective tissue, without any external evidence of inflammation of the lymphatics leading to the glands. In other cases the red line of inflamed absorbents will be visible without glandular complication, or more than a slight induration of the gland. At times there will be suppuration only along the track of the lymphatics, but none in the glands, this suppuration taking the form of local abscesses. I have seen in a case of absorbent inflammation of the forearm and arm four distinct abscesses in the line of inflammation, with only axillary glandular tenderness.

The duct may be ruptured.

Occasionally the lymphatics appear as a hard cord beneath the skin. In a case I had under my care some years ago this cord remained hard and contracted for many weeks after all signs of inflammatory action had ceased. It was in a gentleman who was in the habit at night of going through some simple muscular exercises, and in doing this the cord in the arm on the inner side of the biceps snapped across. I saw him a few minutes after the accident, and felt the two ends of the cord; they were apart for about an inch. The next morning the thin skin covering the anterior surface of the forearm was elevated, loose and baggy, from the effusion beneath it of fluid. There were no signs of inflammation or pain beyond local tenderness at the point of rupture of the lymphatic cord. In four or five days the fluid was reabsorbed, and convalescence was restored, the hard cord gradually disappearing, and all traces of its separation becoming lost. I looked upon the effused fluid as lymph that had been poured out by the divided tube, and had been taken up again. I have never seen a similar accident since.

Seat of absorbent inflammations.

This absorbent inflammation is most common in the extremities; it may, however, occur anywhere. There seems little room to doubt that a large number of the cases of glandular abscesses are of this nature; pelvic abscesses in women are known to be of this kind, for pus has been found in the absorbents of the part.

Glandular suppuration in the neck is, from its position, a dangerous affection,—the connective tissue of the parts being so loose, and the fascia covering them so firm, that burrowing suppuration often takes place. These deep-seated suppurations should be opened early, as soon as any local evidence of pus exists; and in this way, viz. by cutting through the fascia with a lancet, and thrusting a director or forceps into the deep connective tissue. I have opened an abscess at the base of the tongue in this way, from beneath the jaw, with an excellent result. The swelling affected deglutition and respiration, threatening life.

Treatment of absorbent inflammation.

Local.

Treatment.—Whenever any indications of absorbent inflammation show themselves, the wound or sore should be well cleansed, the scab removed, and any collection of pus let out. The limb should be raised, the foot higher than the hip, the hand or elbow higher than the shoulder; and warm poppy fomentations applied along the whole course of the lymphatics up to the group of glands in which they terminate. A poultice may be applied to the wound. Some Surgeons, particularly the French, advise that the inflamed line should be pencilled with caustic, and dry warmth applied, such as cotton wool; but I prefer the practice I have indicated; it seems to give more comfort. Leeching is rarely, if ever, required.

As soon as suppuration appears the abscess must be opened, whether this follows directly upon the inflammation or subsequently; for, at times, suppuration is very insidious. At the very earliest period of the inflammation, when the tongue is foul, an emetic certainly seems to have some influence in checking its progress; it is a simple remedy, and a valuable one. A good saline purge is also of use.

Constitutional.

Sedatives must be given to allay pain, such as small doses of morphia, three times a day, with a double dose at night, to give sleep; and tonics when suppuration has taken place, iron being the best.

In chronic cases, where induration in the track of the ducts remains, mercurial ointments and friction are sometimes of value.

Glands are very prone to inflame after fevers or the exanthemata, the cervical particularly so; and these affections often give rise to much local distress. In patients who are not extremely feeble these enlargements, as a rule, subside by themselves under careful management. In exceptional cases they suppurate.

Local warmth, applied by means of cotton wool, tonics and nutritious food, are the best means to use; but when suppuration threatens, warm fomentations are more grateful to the patient. Abscesses should be opened early. Before opening the abscess, it is well to try what drawing-off the pus by means of the "aspirator" may do, repeating the operation as the pus re-collects; in some instances a cure may be effected by these means, and thus the scar is prevented. Should it fail, an incision must be made.

Opening of abscess.

The local application of iodine under these circumstances, although a common remedy, does not appear to be of any value.

Chronic glandular enlargement is a very common affection; when found in the so-called strumous subject the disease is regarded as a strumous one of the glands, but it is very difficult to lay down any definite cause for its appearance. It is found, it is true, in the strumous and feeble child as a chronic and slightly painful enlargement of a gland or glands, more particularly those beneath the jaw and about the neck; it comes on sometimes after exposure to cold, some slight illness, local irritation, or without any definite cause, and often subsides spontaneously on the removal of the cause or on the improvement of the general health. There exists, probably, always some local cause of irritation. At times, these glands suppurate and leave ugly sores, the cellular tissue around the gland becoming destroyed, and the skin consequently undermined. The pus from these glandular enlargements is, at times, ill formed and curdy; when it attends the breaking down of some old disease it may contain chalky deposit, this being some degenerated or dried-up tuberculous or other matter.

Chronic glandular enlargement.

Hodgkin's disease of the glands.

Hodgkin's disease of the glands.

There is, however, another chronic enlargement of the glands that appears to differ in all ways from the local enlargements to which attention has just been drawn. It was first described by Dr. Hodgkin in the 'Med.-Chir. Trans.,' vol. xvii, and may be called Hodgkin's disease of the glands, or glandular tumours, for the sake of distinction. He observed it first in the mesenteric glands, but any or all may be affected. In it the glands become very much enlarged, even to the size of an egg, and apparently more numerous; they present a smooth external appearance, and have a soft semi-fluctuating elastic feel. On section the surface of the gland presents a smooth, bloodless, semi-transparent, loose, succulent structure; microscopically it is made up of glandular tissue and abundance of fibro-nucleated tissue; it is of a tough leathery consistence, and exudes a clear serous fluid; the tumours are always free, each being separable from the others.

To the Surgeon the disease, at times, appears as a local moveable glandular tumour of a slow painless growth, which medicine has no power of influencing; it has the local clinical appearances of a benign fibro-cellular tumour, and has often been excised as such.

Characters.

In other instances the tumours are multiple, three, four, or more, existing in one locality, chiefly in the neck. In exceptional instances the tumours are more numerous. I have a case now under observation in which, on one side of the neck, the subcutaneous tissue seems filled with loose glandular tumours, readily moveable one upon the other, as if simply confined by skin, in the same way as the adenoid tumours of the breast are occasionally met with. In still rarer examples the whole glandular system seems to be affected, every group of glands not only being apparently enlarged in size, but also increased in number.

This disease is often associated with an enlarged spleen, and appears pathologically to be allied to that blood disease now known as leucocythæmia, notwithstanding that in many cases the white corpuscles are not in excess.

On one occasion I had an opportunity of watching the gradual development of this affection. The disease began in the cervical glands, and gradually involved the whole glandular system, the boy, at the age of fifteen, dying with an enormous spleen and glandular tumours in every region. His blood was made up almost entirely of white blood-corpuscles, and death took place from exhaustion.

Treatment of enlarged glands.

Treatment.—For the ordinary or strumous enlargement of the glands in children there is no drug equal to cod-liver oil, the syrup of the phosphate or the iodide of iron or the tincture of quinine being capital additional remedies.

I have not much faith in the local application of iodine in the form of the tincture; after the second application the skin ceases to be an absorbing surface, and the iodine becomes, therefore, an irritant. For some years I have been accustomed to order the solid iodine to be put into a perforated box, and this to be placed upon a shelf in the sitting and bedrooms; the iodine in this way evaporates gradually and iodises the air. In all glandular, as in thyroid enlargements, this mode of employing the drug seems to be of great value.

The iodide of ammonium as an ointment is a useful application when rubbed in, the iodide in this way becoming absorbed.

Good food and good air are also essential points in the treatment of these cases.

Treatment in Hodgkin's disease.

In Hodgkin's glandular tumours iron in full doses and cod-liver-oil seem to be the best remedies; that is, patients who can take them appear to improve in their general health, and the disease does not progress so rapidly under their use as without; but, upon the ultimate issue, no remedy seems to have any decided influence, and it always ends fatally in two or three years. When isolated glandular tumours exist they may be dealt with as local tumours and removed. This practice should, however, only be carried out when the tumour is in the way and interferes with life's value or usefulness. Under other circumstances they had better be left alone.

In all glandular enlargements, however, with the exception of Hodgkin's disease, the local cause of irritation should be looked for, in order that it may be removed; for, practically, it is well to regard all glandular enlargements as due to a chronic source of irritation, in the same way as acute adenitis is known to be a result of inflammation of the lymphatics.

Wounds of the lymphatics. Lymphatic fistula.

Lymphatics may be wounded by accident or design, and no bad result ensue. At times, however, a fistulous opening that discharges lymph may remain. The same consequence may be the result of disease. Dr. H. V. Carter, of Bombay, has recorded three such cases in the 'Med.-Chir. Trans.,' vol. xlv, and Dr. Day another case in the 'Clinical Soc. Trans.,' vol. ii. Through Dr. Day's kindness, I had an opportunity of seeing this case. It was reported on by a committee of the society, and they confirmed the view taken of it. The case was one of hypertrophy of one lower extremity of a boy, with the occasional discharge of chyle from vesicles, which were formed on varicose lymphatics. The hypertrophy had clearly an intimate connection with the distended state of the lymphatics of the limb.

Disease of the glands, as connected with cancer and syphilis, is referred to in the chapters devoted to those subjects.

DISEASES OF THE THYROID GLAND.

General remarks.

The thyroid is a ductless, but highly vascular, gland; it has as large a vascular supply as any gland in the body, and it is supposed to have some connection with blood formation. It is also freely supplied with lymphatics. It is a lobulated encapsuled gland with a cellular structure, the cells containing a glairy fluid. When the gland is simply enlarged it is said to be hypertrophied, or the seat of *goitre* or *bronchocele* (*simple adenoid enlargement*), and it is well known that these goitres attain a large size. Sometimes they are apparently composed of simple increase of tissue, the enlarged gland having much the same appearance on section as the small and healthy one; at other times the structure of the tumour is coarser, more cellular, or cystic (*cystic enlargement*), the cysts occasionally assuming large dimensions; while in a third class the gland is more solid and fibrous, or more or less mixed with cysts (*fibrous or fibro-cystic disease*). The thyroid gland may inflame, and even suppurate; it may be the seat of distinct adenoid tumours, or of cancer. Hydatid cysts have also been enucleated from its body (*vide* Prep., Guy's Hosp. Mus., 1711^{60}).

Varieties of its diseases.

Goitre.

Goitre, or Derbyshire neck, as it is more commonly known in this country, is very frequently met with; in its most usual form it appears as a simple hypertrophy of the thyroid gland, and gives rise to symptoms which are attributable to the size of the tumour; when of moderate dimensions it may not be inconvenient, when large it may be so, and yet produce no symptoms worthy of special notice. At times, small tumours cause symptoms, such as dyspnœa, or the cough as of a broken-winded horse on exertion, and even difficulty in breathing on the slightest cause. At other times they mechanically press upon the large vessels and respiratory tract, and produce headache and a feeling of fulness in the head on stooping or coughing, with evident respiratory obstruction, and even difficulty in deglutition. These symptoms may also appear for a time and then disappear, leaving the patient comfortable in all respects during the intervals. In other cases, goitres which appear to be of the simple kind, under excitement, or other unknown cause, begin to pulsate, and are attended with some protrusion of the eyeballs; these symptoms disappearing by rest and time; the case subsequently reassuming the clinical features of a simple goitre.

Characters and symptoms.

They press on trachea and large vessels.

May pulsate.

May be attended with protruded eyeballs.

Exophthalmic goitre.

Such cases as these stand as a kind of link between the simple goitre and that known as the *exophthalmic* goitre, Graves's, or Basedow's disease; and yet between these two affections there must be some wide difference, for the simple goitre appears to be a local affection, whereas the exophthalmic form is probably part of a more general disease marked by the enlargement of the thyroid body, often prominence of the eyeballs, always palpitation of the heart, a peculiar thrill in the blood-vessels, and a general want of muscular and brain power (Fig. 50). Modern notions tend to indicate that this form of goitre is a neurosis of the cervical sympathetic. "The numerous functional disorders which occur in Graves's disease are either due to temporary congestion of the sympathetic nerve, or a permanent structural alteration of the ganglionic nervous system." (Trousseau's 'Clin. Med.')

This view, however, of the affection is not yet proved; the whole subject requires investigation.

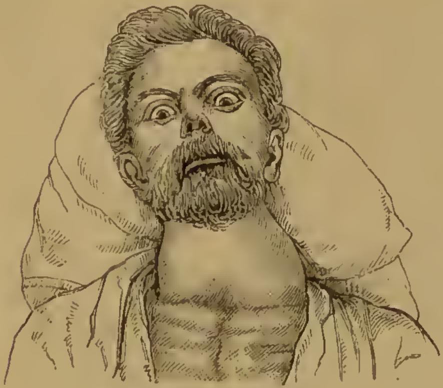
Treatment of goitre.

Iodine.

Iodised air.

Biniodide of mercury.

Fig. 50.



Exophthalmic goitre. Wilks's case.

Treatment.—Simple goitres are to be treated on ordinary principles, by attention to the general health, the inhalation of fresh air, and by tonic medicines. Filtered or distilled water should always be taken, more particularly in districts where chalk, lime, and magnesia abound; for in Derbyshire and the Tyrol districts it is generally believed that it is from the water that the disease is produced. Iodine has always been held in high repute in this affection, originally as burnt sponge, and recently in the form of the iodide of potassium, and in four- or five-grain doses, given with bark or quinine, it is of use. For some years, however, I have given tonics alone by the mouth, and have ordered the air of the room to be kept iodised by means of solid iodine, put into a box with a perforated lid, the metal evaporating steadily into the room where the patient sits and sleeps, and in this way becoming absorbed. Under its influence I have often been surprised to find how rapidly goitres disappear. With this treatment I at times rub in an ointment of the iodide of ammonium, a drachm to an ounce. To paint a goitre with the tincture of iodine is useless, as one application renders the skin hard and incapable of absorption. Dr. Lücke, of Berne, is in the habit of treating hard goitres by injecting strong tincture of iodine into the tumour, one or more punctures being made at a time, according to the size of the tumour. He reports good success. ('Lancet,' 1859.) Dr. Mouat, of Bengal, spoke ('Ind. Annals of Med. Science,' 1857) very highly in favour of the use of biniodide of mercury in combination with the rays of the sun, for the cure of goitre. He used the mercury as an ointment of the strength of three drachms to a pound of lard. It was to be rubbed in for ten minutes, an hour after sunrise, and the patient was afterwards to sit with his goitre held well up to the sun, as long as he could endure it; after this a fresh layer of ointment was to be applied with a careful and tender hand, and the patient sent home, the ointment being left to be absorbed. In ordinary cases this treatment was said to have been enough to effect a cure, it being only in exceptional cases that a fresh application was called for. He gives his cases of recovery in thousands. It is possible that in this country the treatment has failed for want of the rays of the sun. I have tried it without the slightest good.

Tonics.

In Graves's disease iodine appears to be of no use; indeed, it is injurious. Tonics, more particularly iron, are apparently the most applicable.

In exceptional cases a goitre may so increase and press upon the larynx and surrounding parts as to threaten life. It may cause death

May cause death by spasm of laryngeal muscles.

by a gradual process of suffocation, but more commonly by exciting some sudden laryngeal spasm. In 1869 I treated such a case, sent to me by Mr. Holman, of East Hoathly, in which a large thyroid gland was causing chronic suffocation by its mechanical pressure, and it ultimately produced immediate death by exciting some laryngeal spasm. Dr. Herbert Davies has recorded a similar case ('Path. Soc. Trans.,' 1849), and in the Museums of St. George's and Bartholomew's Hospitals preparations exist with similar histories.

Setons.

In some cases the treatment by setons has been of value, suppuration of the thyroid having been followed by a rapid subsidence of the hypertrophied or fibrous structure of the gland. Mr. Hey, of Leeds, adopted this practice with much success. In such examples of goitre the question of operative interference may have to be entertained; it will be considered in another page.

Cystic Bronchocele.

On cystic bronchocele.

Characters.

Contents.

Treatment by tapping.

Seton.

Free incision.

Cysts are often met with in this gland, and at times they assume large dimensions. They appear as more or less globular, tense, fluctuating tumours, moving up and down with the larynx, as all thyroid tumours do. They may contain only the glairy fluid of the gland, or a more serous or sanguineous fluid, or old grumous blood. Occasionally these cysts, on being punctured, will go on bleeding even to the death of the patient. Such cysts appear either in one or other lobe or in the isthmus. In 1872 I treated, with Dr. Hess, a case of blood-cyst of the isthmus in a girl, and drew off about half an ounce of a thick, grumous, coffee-looking fluid. In 1863 I tapped a cyst, the size of a cocoa-nut, in the right lobe of the thyroid of a woman æt. 26, which bled profusely, and the hæmorrhage was only arrested on closing the wound. The cyst filled up at once nearly to its former size, but subsequently gradually contracted, and five or six years later hardly any remains of it could be found. Simply tapping a serous cyst may cure it. When it fails, the cyst may be injected with a solution of iodine, varying in strength from five to ten minims of the compound tincture to a drachm of water or simple alcohol. When these means fail, a seton has been recommended; it is, however, a dangerous practice, and should only be adopted when simpler means fail and interference is requisite. In cysts of the isthmus, more particularly blood-cysts, an incision into the cavity is a good and successful operation. Should a cyst after tapping suppurate, it must be dealt with as an abscess, and opened freely as soon as the existence of pus can be made out, for the thyroid is in a dangerous position for suppuration to appear. I have successfully treated one case of suppurating thyroid cyst after tapping by incision, but these cases are rare.

Mackenzie's plan.

Dr. M. Mackenzie has ('Lancet,' May, 1872) advocated the practice of converting the cystic disease of the thyroid into a chronic abscess by the following means:—"First empty the cyst. When practicable, it is well to make the puncture as near as possible to the median line, and to select the most dependent portion of the tumour for the introduction of the instrument. As soon as the trocar is felt to pierce the cyst-wall it should be withdrawn, and the canula passed further in by means of a blunt-pointed key. The fluid having been withdrawn through the canula, a solution of the perchloride of iron (two drachms of the salt to an ounce of water) is injected through the canula by means of a syringe. The plug is re-inserted, and the canula secured in posi-

Cysts may become calcareous.

tion by a strip of plaster. The injection of iron is repeated at intervals of two or three days, until suppuration is established. When this point is reached the tube is withdrawn, poultices are applied, and the case treated as a chronic abscess. Where the tumour consists of more than one cyst, it may be necessary to make a second or third puncture; but it frequently happens that other cysts can be opened through the cyst originally punctured." Some cysts become calcareous, and such are to be treated by excision. This practice is only, however, to be entertained when the cyst is causing symptoms which threaten life. In the Guy's Hosp. Museum there is a preparation of a calcareous cyst with an intra-cystic growth.

Inflammation of thyroid.

Acute inflammation of the thyroid gland is doubtless a rare affection. I have never seen such a case. Holmes Coote records one in 'Holmes's System.' Suppuration of a cyst in the gland after surgical interference is more common.

Acute hypertrophy of thyroid.

Example.

Required tracheotomy.

Acute hypertrophy may appear, and produce dangerous, if not fatal symptoms. Dr. Risdon Bennett, in his interesting 'Lumleian Lectures for 1871,' has recorded such an instance, which I had the benefit of seeing, in consultation with him and Mr. Jackson, of Highbury. It was in a young man, æt. 19, who, three months before, became the subject of paroxysmal attacks of asthmatic dyspnœa, associated at times with a wheezing or whistling respiration, and some general enlargement of the base of the neck. Three days before his death this difficulty became extreme, the paroxysms became more frequent and more severe, and on the day of his death a severe paroxysm took place, which passed on to a forced and heaving respiration, beyond anything I had ever before witnessed, and speedy death resulted. I performed tracheotomy upon the patient, with the slender hope that some light might be thrown upon the nature of the case to guide us in its treatment, if not to give relief, but in doing so, what was probable before became evident, viz.:—that the obstruction was below. I had no perforated instrument with me long enough to force down, so a female catheter was used, but it struck against some solid body that prevented its progress. After death the thyroid body was found to be much enlarged, but mainly below the sternum and along the sides of the trachea. The trachea below my opening was flattened laterally to within half an inch of the bifurcation; it was also twisted to the left, and was surrounded by the greatly enlarged and firm lateral lobe of the thyroid. The structure of this enlarged gland was clearly that of hypertrophy, not of cystic or other apparent disease. As an example of acute rapid hypertrophy of the thyroid, the case, says Dr. Bennett, "points to the propriety of regarding any acute enlargement of this gland in young people with more anxiety than we are perhaps accustomed to do," particularly, it should be added, when the lobes of the gland pass down behind the sternum.

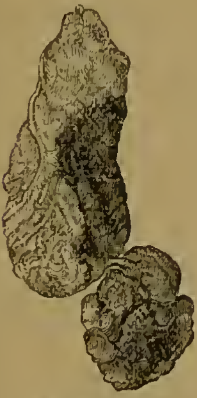
Thyroidal tumours.

Thyroidal tumours, doubtless, exist, although they are not common; these may be *adenoid* innocent, as well as *cancerous* growths.

Characters.

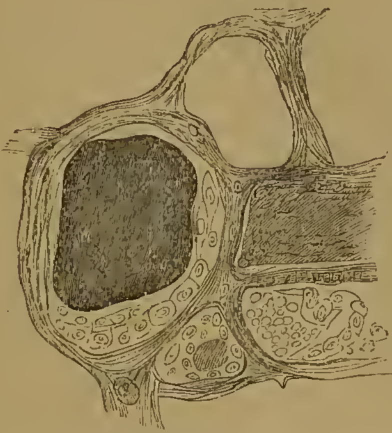
An adenoid growth may appear as a tumour within the gland itself, or connected with it, or more commonly as an intra-cystic growth, similar to that seen so frequently in the breast. In their clinical history such cases cannot well be diagnosed from the ordinary goitre, although, when the disease is unilateral, and assumes a rounded or irregular form, and appears to be an isolated outgrowth of the gland itself, the nature of the tumour may be suspected; when placed, however, within the gland itself, or within a cyst in the gland, the diagnosis is impossible. In the figure below (Fig. 51), taken from a drawing by Dr. Moxon, of an old preparation in the Guy's Hospital Museum (1711[45]), a tumour the size of a grape is depicted hanging down loosely by a pedicle attached to a lobe of the gland, and in the gland there is a well-marked, cup-like depression, from which the tumour had fallen out, the pedicle mainly consisting of a large artery emerging from the gland. The growth had an ossified capsule, and was composed of a structure like that of thyroid tissue (Fig. 52). A like case has also been recorded by my late colleague, Mr. Poland, in which excision was successfully performed ('Guy's Hosp. Rep.,' 1871). Frerichs, Rokitansky, and Virchow record somewhat similar instances. Paget thus refers to the subject of accessory thyroid tumours: "Those growths of new gland tissue may appear not only in the substance of the enlarging thyroid, but external to and detached from the gland. Such outlying masses of thyroid gland are not rare near bronchoceles, lying by them like the little spleens one sees near the larger mass. Their history is merged in that of bronchoceles (see 'Virchow,' lect. 22), with which they are usually associated, whether embedded as distinct masses in the enlarged gland, or lying close to it, but discontinuous."

FIG. 51.



Pedunculated thyroidal tumour.

FIG. 52.



Microscopical appearance of thyroid glands. (From Dr. Moxon's drawing.)

Paget on thyroidal tumours.

Cancerous growths appear as infiltrating affections of the gland, or as distinct tumours; they have no distinct clinical characters until they attack by continuity the tissues around or break down. The Guy's Hosp. Mus. contains four preparations of this disease.

Cancer of thyroid.

Operative interference in thyroidal tumours.

Many operative proceedings have been suggested and adopted for goitre and thyroidal tumours. Sir W. Blizard, Earle, and Coates ('Med.-Chir. Trans.,' vol. x), tied the superior thyroid arteries, with the view of starving the disease, and in Coates's case with success; but the operation is necessarily a severe one, and the free arterial supply from

On removal of thyroidal tumours.

Ligature of thyroid arteries.

the inferior thyroid arteries tends to neutralise its good; at the present day it is properly discarded. Setons have likewise been used for this affection, and with good success, they deserve a more extended trial; but excision is probably the only operation that is worthy of consideration when any operative measure at all is to be entertained. It need hardly be said, however, that no Surgeon would venture to recommend the removal of a thyroid gland or tumour, unless from its growth life was jeopardised, and less severe measures had failed or were inapplicable; under such circumstances the attempt is justifiable. That it can be done successfully has been proved by Dr. W. Warren Greene, of Maine; and in the 'American Journal of Medical Sciences' for January, 1871, two such cases are recorded. Mr. Poland's case, already referred to, is another in point, and more recently Dr. P. H. Watson's.

Setons.

Greene's cases of excision.

Hæmorrhage is the chief danger to be dreaded in the operation, but if the fingers be well used to enucleate the growth, its capsule be not divided or cut into, and the pedicle, which contains the vessels that supply it, be rapidly reached and ligatured, bleeding may be disregarded. As an extra point of caution it appears to be a sound practice to ligature all parts that require division before cutting them, in the same way as the Surgeon does in ovarian cases, and for the same reason. Should the tumour turn out to be an adenoid growth, in or connected with the gland, as in Poland's case, it may be removed with comparative facility, and should it be an enlarged gland itself, even a pound and a half in weight, success may follow, as proved by Greene's and Watson's cases. Indeed, I cannot do better than give the several steps of the operation in Dr. Greene's own words:

Dangers of the operation.

Steps in the operation of removal of thyroid tumours.

1st. Exposure of the tumour by linear incision of ample length, avoiding most sedulously any wounding of the tumour or its fascia propria.

2nd. Division of the fascia propria upon the director.

3rd. The reflexion and the enucleation of the tumour with the fingers and handle of the scalpel, paying no attention to hæmorrhage however profuse, but going on as rapidly as possible to the base of the gland, and compressing the thyroid arteries.

4th. Transfixion of the pedicle, from below upwards, with a blunt curved needle, armed with a double ligature, and tying each half, or, when practicable, dividing the pedicle into as many portions as there are main arterial trunks, and tying each portion separately.

5th. Excision of the gland, and subsequent dressing of the wound, as in ordinary cases.

Dr. P. Heron Watson, in an interesting paper on the operation ('Edin. Med. Journ.,' Sept., 1873) strongly advises that "the investing fascial sheath of the thyroid should be left undivided until the mediate ligature of the vessels included in their fine cellular sheath has been effected," and he proved by cases that this can readily be effected through the wound made for the removal of the gland. He condemns anything like roughness in the removal of the gland, and believes that the operation he advocates and had successfully performed in five cases is easy and rapid in execution and devoid of risk.

I cannot forbear, however, from quoting Dr. Greene's remarks, they are so full of sound sense and wisdom. In conclusion, he writes: "I cannot refrain from one word of warning to my younger brethren, whose ambition may make their fingers tingle, lest they should, in the

Greene's remarks.

light of these successful cases, be too easily tempted to interefere with these growths. It is, and always will be, exceedingly rare that any such interference is warrantable, *never* for relief of deformity or discomfort merely; only to save life, and if it is, beyond all question, determined in any given case that such an operation gives the only chance for snatching a fellow-being from an untimely grave, be it remembered that accurate anatomical knowledge, and a perfect self-control under the most trying ordeals through which a Surgeon can pass, are indispensable to its best performance."

SURGERY OF THE NERVOUS SYSTEM.

INJURIES OF THE HEAD.

CHAPTER VI.

CONTUSIONS AND WOUNDS OF THE SCALP.—BLOOD TUMOURS.—OSTITIS.

Preliminary remarks.

Injuries of the head are always of importance, and a blow upon the head is never to be treated lightly; for although it may not be followed at the time by any symptoms of brain disturbance, and the only apparent result be a simple bruise, the bone may have suffered with the integument, and, as a consequence, grave results may ensue, for an acute inflammation of the diploë of the skull is a condition fraught with danger, and a chronic inflammation of the bone is scarcely less serious. When, as a primary effect of injury, evidence exists of brain disturbance, the importance of the case is increased, for the severest effects may follow the simplest accident. It is well for the student to have these truths impressed on his mind at the beginning of a chapter on injuries to the skull, for they have a practical bearing of vast importance.

Contusions of the scalp and blood tumours.

The integuments of the scalp have this peculiarity, that they are intimately connected with the aponeurosis of the occipito-frontalis muscle; indeed, practically, these parts may be regarded as one, for they are not to be separated, and they move together over the cranium. They are well supplied with vessels, and, consequently, have good power of repair, and rarely slough. A *simple contusion* of the scalp, uncomplicated with any great effusion of blood or other local injury, requires little surgical attention; it has a tendency to recover like contusions of other parts, although when complicated with any great effusion of blood, difficulties arise. When any great

Simple contusion.

Blood tumours of the scalp in newly born children.

effusion of blood complicates a contusion a *blood tumour* is said to exist, and when this occurs on the scalp the affection is known by the term *cephalhæmatoma*. In newly born children this affection is frequently met with, and it is commonly, although not always, a result of a difficult or instrumental labour. It is usually situated over the parietal bone, showing itself as a more or less circumscribed, soft, fluctuating tumour; but the largest I have ever seen was over the occipital. When the tumour is small and confined to one bone, it is probable that the blood is effused beneath the pericranium. When the swelling is larger and covers in more than one bone, the effusion, doubtless, is poured out beneath the aponeurosis of the scalp and the pericranium.

In the former or *subpericranial form* the indurated base may organise, or inflammatory matter may be poured out around it, and assume the character of bone, more or less covering in the swelling; and in neglected cases, suppuration, which occasionally passes on to involve the bone itself, may follow.

In the latter or *subaponeurotic form*, in which the blood is generally rapidly absorbed, a peculiar crackling sensation, which is very characteristic, will be often given to the hand in manipulation. In feeble infants this process of absorption may be delayed, or may fail to be accomplished; under which circumstances surgical aid is called for.

Blood effusions later in life.

In the adult subject, in addition to the forms of blood tumour just described as a consequence of injury, blood may be effused into the skin itself and appear as a hard unyielding lump.

When a blood tumour has an indurated base, rising from, and apparently continuous with, the bone, with a defined edge towards the centre, the idea may be excited that a fracture with depression exists. Under such circumstances the diagnosis will be assisted by the Surgeon firmly pressing his thumb or finger upon the ridge for a few seconds: this act in a recent case often displacing the fibrin, revealing the uninterrupted continuity of the bony surface, and thus proving the nature of the case. There will also be an absence of symptoms of fracture. When the case is complicated with brain symptoms or a ruptured artery, giving rise to pulsation in the tumour, some difficulty in diagnosis may be experienced.

Treatment.

Ice.

Pressure.

Tapping.

Tonics.

TREATMENT.—In an ordinary case of contusion or blood tumour the best application is a cold or spirit lotion, the muriate of ammonia, in solution, being as good as any. When a rapidly forming blood tumour exists which feels tense or pulsates, powdered ice in a bag should be applied, the cold preventing the flow of blood and encouraging absorption. When the rupture of a large artery, such as the temporal or occipital, is suspected, as indicated by the pulsation of the tumour and other symptoms, it may be advisable to apply pressure over the trunk of the vessel. When absorption of the effused blood does not take place, the cystic swelling should be tapped, the fluid drawn off, and pressure applied; and this operation may be repeated several times, the fluid often becoming serous. Should it fail, an incision should be made, sufficient to allow of the free escape of the pent-up fluid, and to prevent its re-collection; gentle pressure being subsequently applied on the part. In very obstinate cases the tumour may be treated as a serous cyst, and injected with iodine. When the effused blood breaks up, and causes suppuration—a somewhat rare result—a free incision is called for and the case must be treated as one of abscess. During this period tonic treatment is often required to improve the patient's powers. When the tumour is large the patient must be kept quiet, and free from excitement, the diet being carefully regulated according to the special wants of the case. As a rule all these cases do well.

Scalp wounds.

Incised and lacerated wounds.

Incised and lacerated wounds of the scalp are very common, and when uncomplicated with injury to the skull or its contents, they generally do well. Large portions of the scalp may be torn away from its connections with the pericranium or bone, and on readjustment live, although much bruised and injured, the subject of the injury recovering without a bad symptom; the extreme vascularity of the scalp favouring its repair. It is generally thought that these wounds are especially "liable to prove the exciting cause of erysipelas." I am disposed to doubt the accuracy of this assertion, for from my notes of 175 cases of scalp wounds admitted consecutively into Guy's in eight years—and it must be added that only the severe ones are admitted—I find that erysipelas followed only in three. Lacerated or contused wounds of the scalp rarely slough, and should be treated as the incised.

Erysipelas after scalp wounds.

Punctured wounds are, however, liable to be followed by diffused inflammation beneath the scalp.

Punctured wounds.

Treatment.—Under all circumstances and conditions, scalp wounds should be gently and carefully cleaned with tepid water, and their edges adjusted and maintained in position. The hair should be cut off in the neighbourhood of the wound, and the head kept cool. When the wound is not extensive, and its edges can be adjusted by strips of plaster, sutures are not needed; but when any difficulty is experienced, they may be as fearlessly applied to the scalp as they are to other parts; indeed in extensive lacerations the application of sutures is far preferable to any other form of practice, for with their use the wound can be kept clean and moist by water dressing, which is not possible where a quantity of strapping has been employed. One caution, however, must be observed in the application of the suture, and that is, not to include the aponeurosis of the occipito-frontalis muscle, for there is more danger of setting up mischief in the cellular tissue beneath this tendon when this practice is adopted than when the sutures simply pass through the skin itself. The kind of suture is unimportant, although many surgeons prefer the metallic. All sutures should be removed on the second day, as wounds of the scalp heal rapidly.

Sutures.

Mode of application of sutures.

Their removal.

When the pericranium is torn off and the bone exposed, no difference in practice is needed, for the prospects of a satisfactory recovery under these circumstances are as good as they are in a less complicated case. When the bone has been much injured, however, superficial necrosis may follow. Should diffused suppuration occur in the cellular tissue beneath the aponeurosis, the sooner a free escape is given to the matter the better, for such cases are always attended with great danger to the periosteum, the bone, and even the life of the patient. To attain this end the edges of the wound should be separated in parts, or *limited* incisions made through the tissues to the bone. By adopting this practice early, the extension of the inflammation will often be checked,

Diffused suppuration beneath aponeurosis.

Treatment of diffused suppuration beneath aponeurosis.

and the extent of sloughing of the cellular tissue limited. Warm fomentations and water dressings should always be applied.

Prognosis.

When extensive sloughing takes place, there is no reason why a good recovery should not follow, if the powers of the patient are good and the kidneys sound.

Constitutional treatment.

The powers of the patient must be kept up by tonic medicine—iron or quinine—generous diet allowed, and stimulants employed when needed. Sedatives to procure sleep are also essential.

Hæmorrhage and its treatment.

When bleeding is troublesome, the arteries should be twisted, acupressed, or ligatured; when it exists as a general oozing of blood, pressure may be applied either to the wound or to the trunks of the supplying vessels. In rare cases where the deep vessels of the temporal fossa are wounded, and bleeding cannot be arrested, the question of applying a ligature to the external or common carotid may have to be entertained; it has never fallen to my lot, however, to witness such a case.

Contusion of the bones of the skull.

Contusion of bone.

This is, doubtless, a common consequence of scalp injuries both with or without a wound, in the same way that scratching or abrasion of the bones is frequently combined with a laceration of the scalp; and in the majority of such cases a good recovery takes place, it being only in exceptional examples that a different result is met with and an acute inflammation of the bone with all its dangers, or a chronic inflammation with all its difficulties, follows.

Acute inflammation of bone, and chronic inflammation, the result of contusion.

Acute inflammation of the bone is a severe affection, more particularly when the diploë is involved; for the diseased action may extend inwards and give rise to a local suppuration between the bone and the dura mater, or involve the arachnoid, and occasion a diffused inflammation of this membrane and the brain itself.

A chronic inflammation of the bone may be followed by very similar results, or by a thickening of the injured bone.

During the progress of necrosis of the skull these results are always prone to occur, with a low kind of phlebitis of the cerebral sinuses and pyæmia.

Symptoms.

The symptoms which indicate either of these two conditions generally appear two or three weeks after the accident, and vary in intensity according to the action. In acute disease there is more constitutional disturbance and headache, passing on to general brain disturbance, convulsions, paralysis, coma and death. In chronic disease the general symptoms are less severe, and the local milder, but persistent headache is always present. When the inflammation spreads inwards towards the arachnoid and brain, other symptoms show themselves, such as severe local pains passing on to delirium, twitching of the muscles, convulsions, paralysis, coma and death; the rapidity of the progress of the disease governing the symptoms. When marked rigors appear suppuration is indicated, often of the pyæmic form; and convulsions of an epileptic nature are frequently found in the chronic form of the disease. *Persistent headache* after an injury to the head is always a symptom demanding anxious attention, for it too often means progressive mischief within the skull. In the chapter on intra-cranial inflammation this subject will receive further elucidation.

Persistent headache.

INJURIES OF THE CRANIUM.

There are some leading practical facts or principles that should be impressed upon the memory of every Surgeon who has to deal with head injuries; and these I have formulated as follows, believing it to be well to place them at the beginning of a chapter on injuries to the skull.

General propositions.

1. Fractures or injuries of the skull are of importance so far as they are associated with damage to the skull contents; a compound fracture uncomplicated with shaking of, or injury to, the cranial contents, being less liable to be followed by bad results than a simple fracture associated with brain mischief.

2. The amount of injury to the brain cannot be estimated by the severity of the primary symptoms; a severe injury to the brain being frequently associated at first with slight symptoms, and a slight injury with severe symptoms.

3. The character of the accident and the mode of its production are the best guides in estimating the nature and severity of the injury, and its probable results; a fall from a height upon the head, or a blow from a heavy weight causing a general injury of the brain; and a fall upon or a blow from a sharp instrument a limited one.

4. A general shaking (concussion) of the brain, whether associated or not with fracture, simple or compound, may give rise either to temporary suspension of brain functions, ending in recovery; to laceration of the membranes; or to a more or less severe bruising of the cortical structure of the brain, or laceration of its substance; the amount of hæmorrhage complicating the case depending upon the size, number, and healthiness of the vessels that are ruptured. Thus a general shaking or concussion in a healthy brain may produce a temporary suspension of cerebral functions only, when the same injury in an unhealthy or aged one, in which diseased vessels ramify, may be followed by a fatal hæmorrhage or apoplexy.

5. Under certain conditions of the system, a slight concussion will be followed by a fatal secondary inflammation of the brain-coverings, and under other conditions a severe injury to the brain will be followed by no such result, the former termination being commonly found when the kidneys are diseased.

With these general propositions as a guide, which the student should learn and think over, I will now proceed to consider the subject of fractures of the skull.

FRACTURES OF THE SKULL.

Varieties

They may be divided into fractures of the *vault* and fractures of the *base*, a third and large division including those of the *vault and base*. They may likewise be *simple* or *compound*, *comminuted*, *depressed*, or *undepressed*.

Fractures of the vault are generally caused by direct blows upon the part, or falls upon sharp bodies. They include most of the *punctured* fractures and *incised* wounds of the bone, as in sword wounds, &c. They are very frequently compound and comminuted, and when brain injury is associated with fracture of the vault alone, it is for the most part local.

The fracture may appear as a simple fissure, the extent of which is determined by the force employed and its character, the line of fracture being influenced by the sutures and ridges of bone. When the force is local and moderate the fracture may be limited; when concentrated and severe the fracture will be "starred" and generally "comminuted," the fissures radiating in all directions, involving many bones, and passing downwards towards the base. When inflicted with a blunt-edged instrument, the fracture will be depressed in a gutter shape (Fig. 53); when with a round one, as a hammer, the bone will be smashed in more like a "saucer" (Fig. 54). When the fracture has been caused by a fall from a height upon the vertex, or by a blow from a heavy body, the bones of the vault and the base may not only be fissured, but displaced; the sutures even may be dislocated.

FIG. 53.

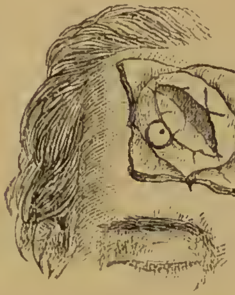
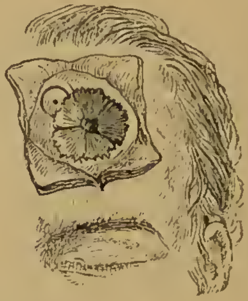


FIG. 54.



Gutter- and saucer-shaped fractures of the skull.

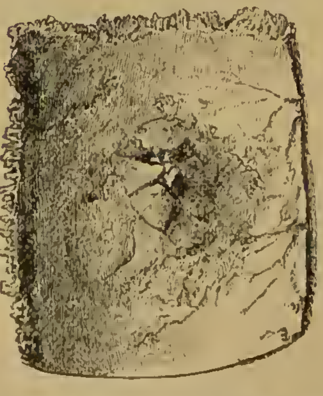
Starred and comminuted.

Comminuted fractures are generally the result of a concentrated local violence, and are consequently chiefly found in the vault, and are mostly compound (Fig. 55).

Depression.

In some cases of fracture of the vault, the bone will be depressed or driven in upon the cranial contents; in rare instances it will be elevated, ploughed up, or displaced outwards, in sabre wounds this result is common.

FIG. 55.



Comminuted fracture of skull with depression of inner table from direct local violence. (Prep. Guy's Mus.)

In some the fracture will be confined to the outer table of the skull, in rare instances to the inner; a fracture, with depression of the inner table, occasionally existing without any fracture of the outer. In Guy's Museum there is a specimen of fractured skull, in which the outer and inner tables are both fractured, but not in corresponding parts.

The direction of the fracturing force has much to do with the form of fracture. When applied from without, and with sufficient violence to involve the whole thickness of the bone, the inner table, as a rule, will be fractured to a greater extent than the outer. When the force acts from within the reverse holds good. This latter fact is best seen in gunshot fractures; and in Guy's Museum, Prep. 1082^{70}, the point is admirably illustrated. It was taken from a patient of Mr. Poland's. The external table is starred, but no fracture of the internal exists; the injury to the bone having been produced by a bullet which had passed through the opposite side of the skull and struck the inner table.

As points of practice, however, it is well to bear in mind that, in all ordinary cases of fracture, with depression, of the bones of the skull, the injury to the inner table is far greater than that to the outer, and the point of exit of any foreign body through the skull is always larger than that of entrance.

Depression without fracture.

Whether depression of the bones of the skull of an adult ever occurs without a fracture is an open question. There is certainly no good evidence in support of the fact. In children it has happened without giving rise to any symptoms of brain compression; but even here, says Mr. Hewett, "some of the bony fibres must have given way." In these cases the depressed bone may subsequently rise up again to its natural level.

Brain complications.

The practical interest, however, that is attached to all these varieties of fracture is concentrated in the question as to how far the cranial contents are involved in the injury. Has the brain been slightly concussed, or so shaken as to have been bruised or lacerated? Have the membranes of the brain been torn, lacerated, or injured? Is the fractured bone a source of irritation to the dura mater? A compound fracture with or without depression, uncomplicated with brain disturbance or brain injury, is a cause of far less anxiety than a simple fracture in which severe brain concussion has taken place, and is indicated by symptoms; a severe shaking of the brain, whether complicated or not with a fracture, being a far more serious accident than any local injury to the skull.

Fractured base, &c.

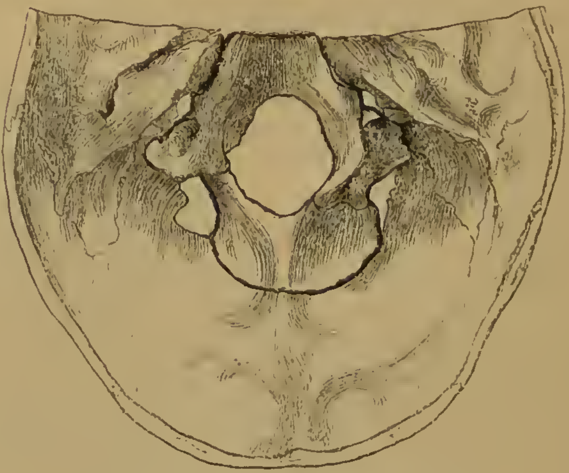
Fractures of the base of the skull, or vault and base combined—for these conditions ought to be considered together—are invariably severe injuries. They are generally, unless produced by a crushing of the head, caused by a diffused force, such as that occasioned by a fall from a height upon the vertex, or a heavy blow. "When the former, the plunge of the body is suddenly arrested by the vertex coming in contact with the ground, and the entire superincumbent weight, with the superadded momentum acquired by the velocity of the fall, is concentrated around the condyles of the occipital bone, and the central compartment of the base of the skull is thus broken across" (Fig. 56). The fracture is the result of direct violence, and not of so-called contre-coup.

The result of direct violence.

Le Gros Clark's explanation.

"Thus, if the injury be inflicted by the fall of a *hard* and heavy body on the vertex, this part would be fractured; and if the weight were not very great, the mischief might end there, as the resistance offered by the head may so far exhaust the momentum of the falling body that the force would not be transmitted in sufficient amount to cause fracture of the base. But if the weight and momentum of the falling body were in excess of the expenditure of force in causing fracture of the vertex, the impulse would drive the head down upon the summit of the spinal column, and fracture of the base would result; in that case, viewed mechanically, the lower fracture would be successive to the upper. But if the falling weight which struck the vertex were of a yielding material, fracture, if any, would be in the base, and not of

FIG. 56.



Fracture of base of skull from fall on vertex.

the vertex, because the *vis inertiæ* of the skull would be overcome, and it would be driven down upon the spine, without the application of circumscribed force to the vault. The same reasoning applies when fracture of either the vault or base, or of both together, is the effect of a fall on the vertex; or this result may be varied by the blow being received on the forehead or occiput; the anterior or posterior divisions being thin, and severally more obnoxious to fracture" (F. Le Gros Clark).

Injuries to the occiput are commonly followed by longitudinal fracture of the base, involving both the posterior and middle fossæ.

Variety of fracture determined by site of the blow.

Injuries to the temporal region or about the ear are followed by fracture of the petrous bone and the middle fossa; they are always serious.

But, in diffused injuries to the head, it is rare to find one fossa alone involved, fissures generally passing through two fossæ, extending from the vault or part struck.

The evidence afforded by my notes of two hundred cases of fatal head injuries bring out these points very strongly.

Dr. Aran's experiments.

These facts have also been experimentally proved by Dr. Aran.

"In precipitating a large number of bodies from various heights on to the head, Dr. Aran found that the part of the vault which first struck the ground gave, as it were, the key to the fracture which would take place at the base. Similar results were also obtained when diffused blows were dealt upon different parts of the skull by means of a large and heavy hammer. In the front part of the vault injuries thus produced led to a fracture of the anterior fossa; in the middle part of the vault they led to a fracture of the middle fossa; and at the back of the head to a fracture of the posterior fossa. In no single instance was a fracture detected at the base without a line of fracture in the corresponding part of the vault. The truth of this has been proved by an analysis which I made of all the cases of fractured base of the skull admitted into St. George's Hospital during a period of ten years." (Prescott Hewett.)

My own observations have gone entirely to prove the correctness of these views. The middle fossa is the one, however, most frequently involved.

Compound fractures of the skull are, as a rule, local fractures. They are generally the result of a concentrated blow upon the part, the force employed having been expended in producing the local injury. They are, consequently, often starred or comminuted fractures and depressed. When the brain is involved in the injury, it is chiefly so beneath the seat of fracture; it is rarely so shaken or concussed as in simple fractures the result of a diffused blow.

Compound fracture often followed by secondary brain inflammation.

The dangers attending a compound fracture are not, therefore, so much from the direct injury to the brain as from secondary intracranial inflammation, the direct result of irritation of the dura mater from the depressed or comminuted bone; the dura mater being frequently punctured or torn by the depressed bone, and in all cases irritated. These facts have an important bearing on practice, encouraging the Surgeon to remove the depressed and irritating portions of bone that have such an injurious influence on the progress of the case. When the brain is injured by the accident, the danger is far greater.

The diagnosis of fracture of the skull.—The best guide to the diagnosis of a fracture of the skull is, without doubt, the nature of the injury. There are no special symptoms by which a fissure of the vault, uncomplicated with a wound, is to be recognised. Upon the post-mortem table extensive fractures of this kind are constantly found, where no suspicion of their presence was entertained during the life of the patient. When a wound complicates the case, a fracture can usually be made out, the broken part appearing as a red line. Care should, however, be taken in these cases not to mistake a suture for a fracture.

Fracture with depression.

When fracture exists with depressed bone the diagnosis is rarely difficult, unless it should so happen that the fracture has taken place beneath the body of the temporal muscle; under such circumstances it is almost impossible to diagnose its existence by direct signs.

Sources of error.

An effusion of blood beneath the pericranium may be mistaken for a fracture with depressed bone, unless care be observed. A natural depression in the skull, particularly in the occipital region, may also be mistaken for depressed bone.

Punctured fracture.

Fracture of the skull, the result of a punctured wound, can, as a rule, be readily recognised, but when the point of the perforating instrument has been broken short off at the surface of the bone, much care is needed.

Fracture of base.

The diagnosis of a fracture of the base, or of the base and vault combined, is always a source of difficulty, and the nature of the accident is, without doubt, the Surgeon's best guide in aiding him in the task; a fall from a height upon the head, or a heavy blow, being the usual cause of such an accident; but a crushing force applied in any direction produces the same result.

Through middle fossa.

Should the fall have been upon the vertex, the middle fossa of the skull will probably be the seat of injury; and the diagnosis of a fracture through the petrous bone may with some confidence be made should hæmorrhage from the ear to any extent have taken place, and this have been followed by the copious discharge of a watery, and perhaps saccharine, slightly albuminous fluid, and by paralysis of the parts supplied by the facial nerve. Hæmorrhage from the ear alone is no positive sign. The moderate discharge also of a watery fluid alone is not characteristic, nor is facial paralysis. Profuse and prolonged bleeding from the ear, followed by a watery discharge, is, however, strongly indicative of a fracture; as is also a copious watery discharge directly following the injury; but facial paralysis, combined with either of these symptoms, renders the diagnosis complete. This watery discharge is now generally admitted to be an escape of cerebro-spinal fluid through a fracture of the petrous bone, passing across the internal auditory canal, and attended with rupture of the membrana tympani. I have known it to continue for eight days.

Bleeding from ears.

Facial paralysis.

Watery fluid from ear.

In injuries to the mastoid process, if a local emphysema exists, the presence of a fracture may be diagnosed.

Fracture of the anterior fossa.

Should the blow or fall have been upon the anterior part of the skull, the probabilities of the case point to fracture of the anterior fossa; and where any injury can be made out to any of the nerves of the orbit, as indicated by local paralysis of some of the muscles of the eye, or by hæmorrhage beneath the conjunctiva, the diagnosis is certain. Hæmorrhage into the eyelids by itself is of no value as a diagnostic sign, although when it follows the accident at a later period, and is consecutive to subconjunctival hæmorrhage, it is a symptom of some importance.

Falls upon the occiput commonly produce longitudinal fissures of the base.

Bleeding from nose.

Copious and obstinate bleeding from the nose or pharynx is by no means infrequent in a case of fractured base, and when accompanied with other suspicious symptoms is of diagnostic value. I have the notes of a case of injury to the head in which the patient apparently died from bleeding from the nose and mouth, no blood coming from the ear; and after death a fracture of the base was found, completely separating the petrous portion of the temporal bone from its connections, and laying open the lateral sinus. The right tympanum was full of blood, but the membrana tympani was entire. The stomach was full of blood, the blood from the lateral sinus having apparently found its way through the Eustachian tube into the pharynx and stomach.

Laceration of lateral sinus.

Laceration of internal carotid.

I have also the particulars of a second case, in which the carotid artery was divided in its passage through the petrous bone, and the lateral sinus laid open, the lungs and bronchial tubes being found filled with blood, even down to the air-cells. Each of these cases lived only two hours after the accident.

A fracture of the base, unassociated with any injury to the brain itself, is of no more consequence than a fracture of another part; but as the base is the most delicate part of the brain, and any injury to it is sure to be followed by severe, if not fatal, symptoms, the subject of fracture of the bones upon which it rests becomes of proportionally greater interest.

Generally attended with brain injury.

A fracture of the base of the skull may be associated with all the intracephalic injuries to which fractures of the vault are liable; it may be complicated with simple concussion of the brain, or with the severer form associated with laceration of the brain-structure, or extravasation of blood upon or within the brain itself. If blood is effused there may be compression of the brain and death, and the same end may be produced by a secondary inflammation of the membranes and injured parts.

Upon the whole, it is difficult to separate the two classes of cases, as the dangers arising from injuries to the skull do not depend upon the seat of fracture, but upon the injuries to the cranial contents; and as the same injuries may be produced by, or rather may be associated with, fractures of the base, the complications and dangers are the same in each.

Having, then, so far stated that the dangers of all forms of fracture of the skull are really alike, and that the same intracephalic complications attend fractures of the vault as of the base, I will now proceed to illustrate the special symptoms which are generally regarded as being diagnostic of such injuries, by a brief analysis of cases from my note-book.

a. Analysis of cases as illustrating special symptoms in cases of injury.

Amongst thirty examples which are recorded there, twelve cases were associated with simple concussion, and recovery took place in all of these. In three cases the fracture extended through the orbit, as indicated by subconjunctival ecchymosis. In eight examples there was hæmorrhage from the ears; in all, this was followed by a discharge of serum, and in seven cases, associated with paralysis of the facial nerve upon the same side. In these cases it is quite fair to conclude that the line of fracture extended through the petrous portion of the temporal bone. In two instances there was bleeding from the nose; in one case there was a serous discharge from the ear, accompanied by paralysis of the facial; in another this discharge followed hæmorrhage from the ear, and was unaccompanied by paralysis.

b. Fatal cases.

To test the value of these different symptoms, as indicating fracture of the base in various positions, the following analysis of the fatal cases will prove of value; and, taking the symptoms separately, subconjunctival hæmorrhage will first claim our attention, as being one which tolerably accurately marks a fracture through the orbital plate. In the eighteen fatal examples, this symptom was manifested in four instances; and in each of these the line of fracture extended through the orbit.

In two cases there was copious hæmorrhage from the ear; in both of these the fracture passed through the petrous bone.

In three examples there was some epistaxis; in one of these the fracture extended across the ethmoid bone; in one the frontal sinuses were full of blood and fractured; and in the third the tympanum was found full of blood and the membrana tympani perfect, and upon careful examination, the lateral sinus of the brain was found to have been lacerated.

Injury of brain.

Seven of the eighteen fatal cases died from direct injury to the brain, the post-mortem examination in all revealing severe contusion or laceration of the brain-structure, with effusion of blood upon the surface of the brain or upon the membranes.

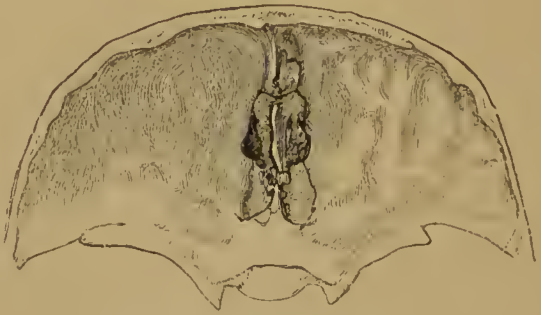
Arachnitis.

Seven other cases died from arachnitis as a result of the injury. In four of these there was contusion of the brain, and in one ecchymosis of the ventricles; in two cases there was no evidence of contused brain, nor was there any effusion of blood; in one interesting case the inflammation spread from the internal ear. In three the cerebral mischief was complicated with some thoracic or abdominal injury, which caused death; and in one instance hæmorrhage was the immediate cause of death.

Rare cases.

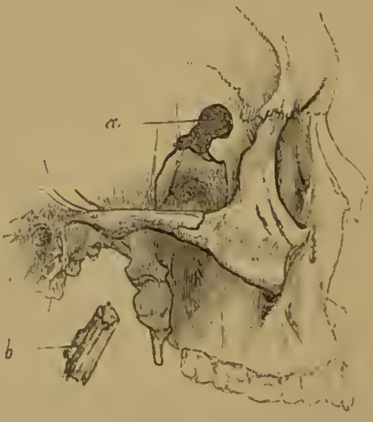
A severe blow upon the nose, by driving in the ethmoid bone, may cause fracture of the anterior fossa of the base of the skull; and I have had under my care a case in which a severe blow upon the jaw produced a fracture of the middle fossa. (*Vide* Fig. 57.) At St. George's Hospital there is a specimen, in which a fracture of the base was caused by the condyle of the lower jaw being forcibly driven against the glenoid fossa with such force that the condyle projected into the cavity of the skull; and in the Guy's Hospital Museum there is a similar specimen, which was sent in with Mr. Hutchinson's prize essay. Punc-

Fig. 57.



Fracture of anterior fossa of the base of skull.
(Prep. No. 1085^{87}, Guy's Hosp. Mus.)

Fig. 58.



a. Punctured wound through frontal bone.
b. Portion of wood which perforated bone.
(Prep. No. 1086^{60}, Guy's Hosp. Mus.)

tured wounds of the orbit are by no means infrequent causes of fracture of the base; many are recorded. I was once called to a case in which a lead pencil had perforated the bone and the brain through the orbital plate; and Fig. 58 was taken from a preparation in which the frontal bone was perforated. The diagnosis of these cases is not difficult. When brain-matter escapes externally through the wound there is no room for doubt.

The treatment of fractures of the skull will be described after the subjects of injuries to the brain and extravasation of blood within the cranial cavity have been considered.

CONCUSSION OF THE BRAIN AND ITS EFFECTS.

Ordinary acceptation of term.

"A man receives a blow on the head, by which he is only stunned for a longer or a shorter period. What is said to have happened? Concussion of the brain.

"A man dies instantaneously, or lingers some time perfectly unconscious, after an injury of the head; there are no marks of external violence. Again, what is said to have happened? Concussion of the brain."

"The head is opened, and what is found? In one case no deviation from the healthy structure; in another, simply great congestion of the cerebral vessels; in another, numerous points of extravasated blood scattered through the brain-substance; in another, a bruised appearance in some parts of this organ. In all, the case, in common parlance, is said to have been one of concussion of the brain. Such are the after-death appearances ascribed by different surgeons to concussion of the brain."

These words of an eminent Surgeon (P. Hewett) so accurately describe the ordinary teaching of the schools, that I have transcribed them as a fitting introduction to the subject I am about to consider; not that they are strictly in accordance with pathological facts, for the experience of the post-mortem room shows that in all cases of death from concussion of the brain, some changes in structure are to be found if carefully looked for, some bruising or laceration of the brain, some bleeding into its substance. In fact, death from concussion of the brain without change of structure does not take place—*concussion and contusion of the brain being always associated in fatal cases.* At Guy's Hospital, during fifteen years, no case is recorded of death from concussion without change of brain-structure.

Mr. Hewett states "in every case in which I have seen death occur shortly after, and in consequence of, an injury to the head, I have invariably found ample evidence of the damage done to the cranial contents."

Concussion and contusion of brain identical.

Mr. Le Gros Clark of St. Thomas's Hospital states—"I have never made nor witnessed a post-mortem after speedy death from a blow on the head, where there was not palpable physical lesion of the brain;" and Dr. Neudorfer, of the Austrian army, declares that he has never seen concussion, properly so called, except in apparently trivial injuries.

M. Fano, a recent French writer, has also come to the conclusion "that the symptoms generally attributed to concussion are due, not to the concussion itself, but to contusion of the brain or to extravasation of blood. In fact, all now agree when death follows a severe shaking of the brain or concussion, that contusion or bruising of the brain is invariably found.

Recovery of bruised brain.

How far these views are correct in cases of concussion that are not fatal is an open question; but in the few cases of concussion recorded in which death has followed from other causes, some injury to the brain substance has always been found; and in all instances in which a fatal result has taken place from secondary inflammation, evidence of some bruising of the brain has been detected. A bruising of the brain, however, with a slight extravasation of blood may be recovered from; although with extensive effusion, compression of the brain and death is the usual result. When it is generally accepted as true that concussion and contusion of the brain are synonymous, the principles of the treatment of such injuries will be better appreciated.

Symptoms of concussion.

In the simplest form of concussion of a healthy brain a slight and transient loss of power and consciousness are the only symptoms. In the more severe form, when a blow or injury produces some severe shaking of the cranial contents, this shaking is followed by a loss of consciousness more or less complete, and a loss of all power of motion; the skin of the patient will be cold, the features more or less contracted, the pulse slow and intermittent, and the pupils very variable—in some cases dilated, in others contracted, while in a third class one pupil will be dilated and the other contracted.

If the case be neither one of great severity nor complicated with any grave injury to the cranial contents, after a variable period the patient will show signs of movement; he will, perhaps, move a limb in an impatient and purposeless manner; if he is spoken to with a loud voice, he will, perhaps, show some signs of returning consciousness, either by making some inarticulate noise or by merely opening his eyes and again returning to his stolid condition.

Reaction after concussion.

If the case be still carefully observed, the mode of respiration may be seen to be altered; from being slow and laboured, it will be irregular, and perhaps sighing. After a time, if recovery is to take place, other signs of what are termed *reaction* will make their appearance. The skin will become warmer and more natural, the shrunken and contracted features will return to their normal condition, the pulse will be more regular and rapid, and what is very frequent, vomiting may occur. The appearance of this symptom is generally of moment, and is apparently the first result of a more active circulation through the cerebral centres. If all goes well, the patient rapidly recovers and returns to his natural condition, feeling perhaps somewhat heavy and dull for a few days, and indisposed for any bodily, and much less for mental, labour. On the other hand, the symptoms may persist or pass into those of compression—complete insensibility, coma, and death; or the symptoms of reaction may become excessive, and pass into those of inflammation of the brain or its membranes.

In this brief sketch of an ordinary example of concussion or shaking of the brain the symptoms are, of course, marked, and have been purposely dissociated from those of the complications, liable to occur either primarily or after the period of reaction has taken place.

What change of structure is present in such an injury is, of course, an open question. In the simplest case, the local injury must be slight; in the most severe, there is every probability that some bruising of the brain with extravasation has been produced.

Epistaxis.

Hæmorrhage from ear.

In what is called concussion of the brain epistaxis is very frequent. Hæmorrhage into the lids of both eyes is not uncommon, but beneath the conjunctiva it is very rarely met with. Hæmorrhage from the ear directly after the accident is occasionally seen, and I have known it continue for several hours, but in all these cases the extravasation of blood takes place as a direct result of the accident.

Relapsing unconsciousness.

In certain cases, again, a patient, having regained his consciousness, relapses into insensibility—*relapsing unconsciousness*—from which he may as perfectly recover as if no relapse had taken place. It would appear as if this condition were produced by the earliest effects of reaction, the vessels yielding too freely to the heart's pulsations, and thus producing a plethora of the part, which induces a comatose or semicomatose condition. The following case illustrates these points.

Case of relapsing unconsciousness with epistaxis.

A boy, æt. 11, having received a blow upon the head from a falling piece of timber, became perfectly unconscious and quiescent. He remained in this state for fifteen minutes, and, recovering, he walked home, some short distance. He soon began to feel sick, and vomited, the vomiting being attended with *epistaxis*. He was then brought to Guy's, with a cold skin and labouring pulse. He was very slightly conscious, could not answer any questions, and his limbs remained in the position in which they were placed. The pupils were dilated, but active. He was left in bed with the head raised, and a cold lotion applied to it. Warmth was also applied to the feet. He gradually recovered, leaving the hospital in ten days.

The epistaxis and relapsing unconsciousness in this case, coming together at the time of reaction, point clearly to the cause.

Reaction with convulsions.

Again, in children, reaction is not infrequently attended with convulsions, which generally, however, pass away, and leave no mark behind. Should they appear in an adult, they are symptoms which cause anxiety, as they almost always indicate brain injury and forbode mischief.

Excessive reaction.

When reaction is excessive it is attended with febrile symptoms and those of brain disturbance, such as delirium, excitement, and coma; but intracranial inflammation will claim attention in another chapter.

Extravasation of Blood as result of Concussion.

Effects of violent shaking of brain.

Bruising by contre-coup.

Hæmorrhage on brain.

Diseased vessels.

Hæmorrhage into brain.

If the brain be violently shaken, bruising of its substance and extravasation of blood must take place; when the result of a direct blow, the injury may be only local, but it is more usual to find the opposite side of the brain bruised as well, by what is rightly termed "contre-coup." Indeed, it very often happens that the mischief to the brain by contre-coup is greater than that at the seat of local injury. When the fall is upon the vertex, the base is bruised; when on the occiput, the anterior lobe; when on the right parietal region, the base of the left middle lobe is the injured part; indeed, the base of the brain is almost always the seat of injury. In all these cases blood will be extravasated to a greater or less degree; and when the vessels are diseased the hæmorrhage may be excessive. There will always be some extravasation of blood either upon the brain surface or within it; if upon the surface, it will be either upon or within the membranes, within the cavity of the arachnoid or the meshes of the pia mater, and under both circumstances the blood gravitates to the base. Not infrequently the extravasation of blood takes place into the structure of the brain itself, into some part of the cerebrum, cerebellum or pons Varolii;

it rarely takes place, however, in the form of one large clot, but commonly in small and numerous spots of extravasation.

Results of post-mortem.

On referring to my notes on this subject I find in a case of concussion, fatal sixty hours after the injury, that the brain was found bruised all over, and blood generally effused at the injured spots; the fluid in the ventricles was blood-stained, and the ventricles themselves were ecchymosed. In another case of death from concussion, the result of a fall, in a man æt. 31, in whom convulsions and coma supervened on the fifteenth day after the injury, a layer of blood was found universally diffused over both hemispheres, dipping between the convolutions and passing downwards towards the base. The clot was shreddy, of a dull, reddish-black colour, and had evidently been effused for some days. The surface of the brain beneath the seat of injury was softened, and at the base, where injured by *contre-coup*, like changes had taken place. The vessels were healthy. In another case, where the vessels were diseased and death followed from concussion, multiple extravasations were detected after death throughout the substance of the brain.

In all these typical cases, illustrating the different effects of concussion, a fatal result took place from a severe shaking of the brain alone; no fracture existed to complicate the case. It is to be remembered, however, that where a fracture is present, unless it be attended with depressed bone, the shaking of the brain is the source of danger.

Diagnosis of contusion.

Severity and persistency of symptoms.

From what has been thus stated the conclusion may be drawn that the nature of the accident is the best guide to the formation of an opinion as to the existence of contusion of the brain as well as of its extent; although the severity of the symptoms, or their persistency, is, doubtless, a valuable indication. The French surgeons look upon "tonic spasms of the limbs; intense restlessness, with constant rolling and tossing about in bed; unconsciousness, more or less complete; drowsiness, without any stertorous breathing, and in the slighter cases simply contraction of one pupil or of one eyelid; spasmodic movements about some one muscle or another of the face or lips, giving rise to a difficulty of pronunciation" (Hewett), as symptoms by which this condition is to be recognised. Mr. Le Gros Clark regards the following symptoms as being characteristic of contused brain:—"More or less constant restlessness, accompanied by spasm, in which some particular member is affected, or amounting to general convulsion. If capable of giving expression to his feelings, the patient will point to some particular part of the head as the seat of pain. In some instances noisy incoherency and obtuseness of intellect accompany this condition from the first;" and these symptoms are doubtless enough to point to severe injury, to contusion of the brain. When they appear rapidly after the receipt of the accident, they may be accepted as reliable; but when they come on a few days later they are to be accounted for as well by secondary inflammation of the brain as by contusion. Nevertheless, they may be accepted as valuable diagnostic indications of a bruised brain until better evidence can be brought forward.

Le Gros Clark's diagnostic marks.

Diagnosis of primary contusion and concussion.

The diagnosis of primary concussion and contusion of the brain is, however, almost impossible. The symptoms are so intermixed that the real nature of the lesion is not apparent. The signs attributed to concussion, such as loss of consciousness, collapse, small, scarcely perceptible pulse and lowered temperature, are met with in other affections of the brain, and merely indicate that the functions of that organ, and their influence on the system at large, are in a state of abeyance. It can, therefore, only be declared that the brain was contused in the first instance, *if the symptoms continue.*

Seat of injury indicated by paralysis.

The seat of injury to the brain may likewise be often indicated by some paralysis, partial or complete, of one or more of the cerebral nerves. This paralysis may be only a passing symptom or a permanent one. Paralysis of the seventh pair, including the facial nerve, has been already alluded to as a somewhat typical symptom of fracture through the petrous portion of the temporal bone. This may appear as an immediate result of the injury, indicating laceration of the brain by the fracture; or, what is more usual, at a later date, when it may be the effect of pressure upon the nerve trunk in some part of its course by effused blood; or, at a still later period, by inflammatory effusion.

Injury to the cerebral nerves, &c.

On referring to my own notes of cases admitted into Guy's Hospital at different periods during the last twenty years, I find examples of injury to the optic nerves, as indicated by blindness, paralysis of the muscles of the globe of the eye as a whole, and paralysis of the external rectus muscle. Paralysis of the facial and auditory nerves is very frequent, and at times there is paralysis of the fifth nerve, as indicated by complete loss of sensation of the face, &c. Paralysis of the hypoglossal has also been observed. In the majority of these cases the symptoms appeared as a direct result of the injury; in some they came on two or three days later, associated with febrile symptoms; but in most, they disappeared after the course of a few weeks. In some instances, however, of facial paralysis the symptoms were permanent. In all these cases there must have been injury to the base of the brain. "The coexistence of hemiplegia on one side with paralysis of the third nerve of the opposite side is indicative of lesion of the crus cerebri on the side on which the third nerve is paralysed." (Le Gros Clark.)

Aphasia after injury.

I once had under my care a man who received a severe blow on the left side of the head above the ear; the injury was followed by symptoms of concussion, which soon passed away, but he had complete aphasia; in the course of a few days the ability to speak partially returned, but he spoke so thickly that he was unintelligible; in about three weeks he could be understood, but he did not recover his natural mode of speech for at least three months. During the greater part of this time he had headache, and the least exercise or excess in diet made it worse. There can be little doubt that in this case the base of the middle lobe of the right side had been contused. Mr. Callender tells us "that symptoms of aphasia are more apt to follow injury of a part of the left hemisphere outside the corpus striatum than any other part; that injuries to the right hemisphere are more rapidly fatal than are equal injuries to the left; and that the right-side brain lesions are more often associated with convulsions than are similiar hurts at the opposite side." ('Brit. Med. Journ.,' June 6th, 1874.)

Remote effects of Concussion.

Remote effects of concussion.

There are, however, many injuries to the head which, without producing any definite symptoms, such as have been described as the result of concussion, &c., cause serious, and often permanent damage to the patient.

The effects of a blow on the head are by no means determined by the immediate symptoms resulting, for it has often happened that a person has received a trifling injury, from which he is supposed to have completely recovered, while the case has ended in a permanent enfeeblement of the mental powers. It behoves the Surgeon, therefore, to be most cautious in giving an opinion as to the issue of a case of injury to the head. As the Surgeon's functions seldom extend beyond the early period of treatment it is not necessary here to enter into such cases much in detail, after pointing the moral that attaches to them all.

Insanity. The records of lunatic asylums, unhappily, prove that many cases of apparently trivial injury to the head, unaccompanied by symptoms which would indicate any positive affection, such as concussion, paralysis, &c., have ended in an affection of the brain which has rendered the patient hopelessly demented, and, moreover, has left no visible traces of the malady in the brain after death. Such instances as the following may suffice for illustration.

A boy, æt. 16, fell from a tree and was found partly insensible. After a few days' treatment in a hospital he was dismissed as "cured." In a few months he was in a lunatic asylum, where he remained several years.

A gentleman put his head out of the window of a carriage while travelling by railway, and received a scalp wound from striking his head against a post. He was rendered insensible at the time, but soon improved, and there were no signs of importance, yet in a few weeks he was in a state of mental aberration and died in a year.

A man was kicked by a horse in the stomach and fell, striking his head on the stable floor, but had no cerebral symptoms. In a few weeks he got delirious and confused in mind, and became hopelessly insane in time.

Such instances might be multiplied endlessly, and they point to the supreme importance of injuries to the head, however slight the immediate symptoms. The reader may find this subject well discussed and illustrated by Dr. J. C. Browne in the first volume of the 'West Riding Asylum Reports,' in Abercrombie's works, and elsewhere. It may be laid down as a principle that those with any hereditary predisposition to insanity or nervous disease are more liable to suffer from cranial injuries than other people, and also that the temperate stand a better chance than those addicted to excesses of any sort.

Dr. J. C. Browne says in his paper, before alluded to, "We are justified in concluding that concussion may exert its worst influence without any organic change which is capable of being detected. Everything points to the conclusion that the evil of concussion really consists in what may be called dynamical changes in the nerve-cells and their connecting fibrils."

INJURIES OF THE BRAIN AND ITS MEMBRANES COMPLICATING FRACTURE.

When the student has recognised the fact that a blow upon the head, although uncomplicated with fracture, is capable of producing, by concussion of the brain, injuries such as have been sketched in the previous pages, he will be quite ready to understand that a blow upon the head complicated with fracture is likely to be followed by results that are at least equally severe; he must know that, as the force required to produce a fracture of the skull is either more violent or concentrated than that required to produce what has been described as a concussion of the brain, so there are other complications which are frequently associated with or peculiar to fracture, such as depression of bone producing compression of the brain, extravasation of blood external to the dura mater from rupture of the middle meningeal artery, injury to the dura mater or membranes, and direct injury to the brain. He must be aware, moreover, of the fact that a fracture of the skull may take place without producing any cerebral disturbance; for example—

Fracture without brain complication.

A man, æt. 27, received a blow over the vertex from a broken sword; an extensive scalp wound was the result, and a very evident incised wound in the upper portion of the frontal bone, apparently involving only the external table; it was uncomplicated with the slightest cerebral disturbance. A good recovery followed.

Incised wound of the skull.

A boy received a compound fracture over the frontal region from the kick of a horse; he had no head symptoms whatever, and recovered.

Compound fracture of frontal bone without brain injury.

In the former case there was an incised wound of the skull, and in the latter an undepressed fracture. In neither was the brain shaken, bruised, or otherwise injured, and in both a good recovery ensued. Cases such as these are, however, comparatively rare; the more frequent class being the one that includes all those examples of fractured skull which are associated with brain symptoms similar to those that have been described under the head of simple concussion; cases in which the functions of the brain are for a time more or less interfered with or suspended, but which have a tendency gradually to return to their normal conditions; in which the injury to the skull has been severe enough to break the bone, and general enough to shake the brain and cause a suspension of its functions. The importance of these cases, however, rests upon the injury the brain has sustained, and not upon the fracture; the fracture is only a complication, and so long as there is no depressed bone irritating and compressing the brain, their danger is in no way increased; if, however, in any given instance the injury is complicated with laceration of one of the large arteries of the bone, such as the middle meningeal artery, other conditions may arise which are special to fracture.

Fracture of skull and concussion.

Fractures of the skull associated with extravasation of blood between the dura mater and the bone.—As the result of an injury to the skull, whether with or without a fracture, small extravasations of blood between the dura mater and the bone are not infrequent; they are due to the rupture of some of the small vessels that pass from the bone to the dura mater beneath; they give rise to no symptoms by which they can be recognised, and are usually only discovered after death.

When any large extravasation occurs, it as a rule comes from the trunk or one of the branches of the middle meningeal artery, which runs upwards in a groove of the anterior inferior angle of the parietal bone, and divides to supply the lateral part of the base and vault of the cranium. A fissure, therefore, of the bone in these parts may lacerate one of these branches, and give rise to a hæmorrhage sufficiently copious to produce symptoms of compression of the brain.

Source of hæmorrhage middle meningeal artery.

It is well, however, to know that the brain will sustain a good deal of pressure without giving rise to any symptoms, and that several ounces of blood rapidly effused are required to produce such symptoms as are recognisable. In rare instances the hæmorrhage may come from one of the large venous sinuses which has been torn.

Torn venous sinus.

The following case is a good one to illustrate the accident.

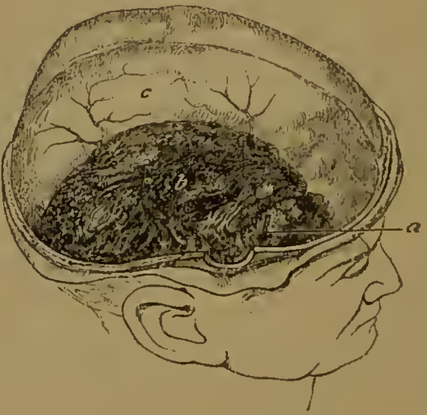
Case.—A man, æt. 49, when riding in a gig, was thrown out upon his head; the accident produced a scalp wound over the left side of the vertex and some slight insensibility, and he got up and walked for half an hour, when he became confused, and staggered; he went into a shop, and was supposed by the shopkeeper to be intoxicated, but as he gradually became quite insensible he was brought to Guy's. When admitted he was perfectly unconscious and comatose, with dilated pupils, labouring pulse, and slow respiration; he very soon became convulsed, the right arm being more affected than any other part; this, however, in a few hours became paralysed. He remained in this condition two days, and died comatose. After death, upon removing the calvaria, which was fissured in a vertical direction from the middle of the left parietal bone to the jugular foramen, a large clot of blood was seen lying upon the dura mater, clearly proceeding from the middle meningeal artery; it was about two and a half inches in diameter, and more than one inch in thickness; it formed a *globular tumour*, and caused an extensive depression upon the left cerebral hemisphere; it pressed the longitudinal fissure to the right side. The brain itself was healthy. Prep. 1606^{50} in Guy's Hosp. Mus. shows the condition. In Fig. 59 these parts are well seen.

Interval of time between accident and effusion of blood.

This case may fairly be accepted as a typical example of this form of injury, and special attention should be paid to the fact, that the man recovered from the immediate effects or shock of the accident, remained sensible for a definite period, and then gradually became unconscious. In compression from hæmorrhage this "interval of time" between the accident and the occurrence of the symptoms is most important in a diagnostic point of view; it is very commonly, although not constantly, present; but when present it is characteristic of hæmorrhage in some form. The symptoms to be those of compression must also be lasting; these symptoms must not be mistaken for the "relapsing unconscious-

Persistency of symptoms.

Fig. 59.



Drawing showing clot (*b*) external to the dura mater (*c*) from laceration of the middle meningeal artery (*a*), following a fracture. (Drawing 80^{20}, from a case of Hilton's, G. H. M.)

ness" of a shaken brain, to which attention has been already directed. The persistency of the symptoms is consequently a valuable diagnostic symptom.

But how, it may be asked, is extravasation of blood, the result of a lacerated meningeal artery, and therefore outside the dura mater, to be diagnosed from extravasation of blood within the cavity of the arachnoid, upon the surface of the brain, or within the brain itself? For under all these circumstances the symptoms may appear some time after the accident, the inference drawn from the "interval of time" being the same in each; under all, the symptoms of compression will be identical, for they will be those of apoplexy, and, as in apoplexy, they will vary in each case; for "when extravasation takes place on the surface or within the substance of the brain, it is accompanied and, indeed, produced by lesion of the cerebral texture, which lesion is mostly indicated by paralysis, by irritation or spasmodic action affecting some particular part, by derangement of the pupils, or by other symptoms." (Cock.) The Surgeon's best guide in aiding him in his diagnosis will, however, always be the history of the case, when it can be obtained, and the nature of the accident.

Blood external to dura mater.

In uncomplicated cases of hæmorrhage *external to the dura mater* the injury is generally produced by a sharp blow or fall, and a local one; the brain, as a whole, is not shaken or injured; the symptoms of compression are, moreover, generally very marked and very rapidly produced, and the paralysis of half the body is also commonly complete.

Blood internal to dura mater.

In cases of hæmorrhage *into the arachnoid cavity, or upon the surface of the brain*, the injury is mostly of a general character, such as a fall from a height or a blow from a heavy weight; the whole brain has been violently shaken or "concussed," and as a result its delicate structure, more particularly at the base, has been bruised or lacerated, weak or diseased vessels being very apt to give way, and give rise to hæmorrhage. Hæmorrhage external to the dura mater may be present in these cases of general injury, it is true, but it will be complicated with the same extravasation into other parts; and this point of diagnosis is all important, for in the former class of cases, surgical treatment may be of inestimable value, whilst in the latter it can be of no service.

Hæmorrhage on surface of brain after fracture with bruised brain.

Hæmorrhage upon the surface of the brain is a very important subject, for it occurs in variable degrees in every case of severe or general injury to the skull, whether complicated or not with fracture; the brain itself may be not only bruised at the seat of injury, but it will be equally, if not more, injured at the opposite point by *contre-coup;* and this bruising and extravasation is generally found at the base of the brain. The hæmorrhage that is associated with this bruising may be so slight as to give rise to no symptoms, and recovery may take place; or it may be so severe as to give rise to symptoms of compression. But when a large vessel of the pia mater is ruptured, the bleeding will be severe, and under these circumstances the blood may spread into all the parts down to the base, covering in the cerebellum and spinal cord.

It is this fact that renders all cases of *general injury* to the brain so serious, and tells so powerfully against any operative interference in this class of cases, the Surgeon being quite unable to reach the source of compression by trephining.

Hæmorrhage into the cavity of the arachnoid is by no means a

Hæmorrhage into cavity of arachnoid after injury.

common consequence of head injury, but it may occur, either as a result of a local or direct injury to the skull, or of a diffused one; and the effused blood may be poured out upon one or both sides of the cerebrum. When the effusion is gradual and not extensive, no definite symptoms of compression will be produced; and when extensive, although symptoms of compression may appear, there will be nothing to indicate the precise position of the hæmorrhage.

Patients with kidney disease.

In patients who have albuminuria, or diseased arteries, there is reason to think that a slight injury to the head may cause extravasation of blood into the arachnoid, and this fact has an important practical bearing, and gives a key to the solution of many a doubtful case of head injury.

Arachnoid cysts after hæmorrhage.

Pathology has taught us that these clots may organise and form what are now known as arachnoid cysts, having smooth external surfaces like a serous membrane; when recent, they will be soft and pulpy; when old, fibrous. They may contain only serous fluid, more or less blood-stained, or clots of blood altered by time. Sometimes these cysts are found to be loose in the arachnoid cavity, at others fixed to the parietal arachnoid. They are usually found after death accidentally in those who have suffered from mental disorder or general paralysis, and although they more commonly exist on one side of the head, they are found on both.

To Mr. Prescott Hewett ('Med.-Chir. Trans.,' vol. xxviii) must be assigned the credit of explaining how these cysts are formed from a chronic change in previously effused blood. But for a full elucidation of the subject we are indebted to Drs. Wilks, Ogle, Bacon, and Sutherland ('Journal of Mental Science,' vol. x and xi; 'Rep. West Riding Asylum,' vol. i).

COMPRESSION OF THE BRAIN.

Varieties.

The brain may be compressed in many ways; but there are four special causes of compression:—Compression from *depressed bone*, the result of fracture, simple or compound; compression from the *extravasation of blood* into any part of the cranium; compression from the *effusion of inflammatory products* into the brain or its membranes; and compression from the *formation of matter* between the dura mater and the bone.

Onset of symptoms in each variety.

The symptoms of compression under all these different circumstances are much alike, although the clinical history of the cases and the date of the appearance of the symptoms after the injury varies, in each class. When the result of depressed bone, the symptoms are the immediate consequence of the accident. When caused by extravasation of blood, there is almost always some interval of time between the accident and the accession of the symptoms, although that interval may be but short. When caused by the effusion of inflammatory products into or on the brain, the symptoms generally appear some days after the accident, and are gradual; and when the result of the formation of matter between the dura mater and the bone, the symptoms rarely show themselves for two or three weeks after the accident. In both of the last two classes of cases, moreover, headache and inflammatory symptoms coexist.

Symptoms those of apoplexy.

The symptoms of compression of the brain are those of apoplexy, and their severity depends entirely upon the suddenness and amount of the compression. The skull may be fractured and the bone depressed and yet no symptoms arise. Extravasation of blood may also take place to a limited degree within the skull and not be recognised; indeed, there is good reason to believe that a considerable amount of blood may be poured out *slowly* upon the surface of the brain without giving rise to compression, the brain gradually accommodating itself to the pressure. The most marked cases of compression are attended with rapid extravasation. When the bones are much depressed, or the brain is suddenly compressed by the local effusion of blood, symptoms show themselves: such as complete insensibility, slow, difficult, and perhaps stertorous respiration, and a full, slow, labouring pulse. The pupils may be dilated or contracted, but they will be always fixed—they will never respond to light. In very severe cases the respiration will be of a peculiar *puffing* character. There may also be complete loss of the power of swallowing, inability to retain fæces, and retention of urine; incontinence or overflow of urine being the last symptom.

When the brain is compressed by an effusion of blood, or other cause which acts uniformly over the surface, the symptoms are "general," *i. e.* one side is not more paralysed than the other; but when the cause of the compression is more localised, the paralysis is partial and corresponds with the region affected, though when the local extravasation is extensive, the general effect may mask the local symptoms. The best examples of this form of limited compression are found in cases of fracture of the skull from a local injury, and extravasation of blood between the bone and the dura mater. The case quoted on page 214 is a good one in point; but the following is probably a better one, as it is complete.

Hæmorrhage between bone and dura mater without fracture; trephining; recovery.

J. P—, æt. 46, a painter, having fallen from a height upon his head on a piece of iron, received a severe scalp wound on the right side of the median line of the head, with slight concussion. He was admitted into Guy's under Mr. Cock's care in 1841, conscious, and remained so for eleven hours after the injury; four hours later he was found in a state of perfect unconsciousness, with stertorous breathing and insensible pupils. He continued gradually to get worse. On pinching the left arm and leg they were readily retracted. The right side was completely paralysed. No fracture could be discovered. Trephining was performed above and behind the anterior inferior angle of the left parietal bone over the trunk of the middle meningeal artery, and a large piece of bone removed. A gush of blood took place, and a large coagulum was removed from outside the dura mater. The deep stertor at once ceased, and the next day the man moved his right arm and leg freely, and recognised his wife. He progressed favorably after the operation, though recovery was retarded by bone exfoliation. He resumed his work and occupation, and continued in good health for thirteen years. During this period, however, at intervals he had exfoliation of some portion of the skull at the seat of injury; in the ninth year he had fits, which recurred at intervals during the last six years of his life, and the attacks, as Mr. Cock reported, became gradually more frequent and severe in their character. Six months before his death he had paralysis of the opposite side of the body to that of the injury; the face was included in the paralysis, and the speech was somewhat affected. He died after a severe apoplectic fit. After death the brain beneath the injured bone was found softened and adherent to the skull; it contained a recent clot of three or four ounces of blood, which filled the ventricles. "It appeared probable," says Dr. Wilks, who made the examination, "that a softening had been going on for some months in the middle hemisphere of the brain, involving the contiguous surfaces of the corpus striatum and thalamus, and that at last a rupture of the vessel had taken place, infiltrating all these diseased structures as well as the ventricles." The trephine opening was filled in by a tough membrane; around its margins there was evidence of considerable ostitis having taken place. (Cock, 'Guy's Hosp. Reports,' 1857.)

a. Local injury and local paralysis.

When a patient receives a direct blow upon one side of the head, causing a fracture with depression of the bone as an immediate result of the injury, with paralysis of the opposite side of the body and a fixed and dilated pupil on the side of the injury, the conclusion is inevitable that the depressed bone is the cause of the paralysis, by producing pressure upon the brain, although the depression must be very great to give rise to such symptoms.

When another patient sustains a similar injury, with or without depression of the bone, but followed after a distinct interval of time by paralysis of one side of the body, whether of the injured side or not, it is quite fair to infer that hæmorrhage has taken place inside the skull, and is the cause of the compression.

In both of these cases a local injury is followed by local mischief, causing a local paralysis, and surgical treatment is of great promise.

b. Effect of general concussion of brain, with or without fracture.

When a patient receives a general injury to the head—such as commonly results from a fall upon the head from a height or a diffused blow from a heavy falling body—and this is followed directly, or after an interval of time, by symptoms of compression, whether associated or not with a fracture, the paralysis is, as a rule, general; and even if more complete on one side than another, the injury to the brain is, for the most part, too diffused or extensive to admit of surgical relief. The case is clearly of a mixed nature, contusion or laceration of brain-structure being associated with hæmorrhage.

Symptoms of brain injury.

When a patient suffering from brain shock, with or without a fracture, is unconscious, motionless, and perhaps pulseless, has lost control over the action of the bowels and the bladder, has a feeble respiration and paralysed pupils, it is impossible for the Surgeon to form any opinion as to the nature of the cerebral injury; for these symptoms may be the result of so-called concussion, from which recovery may take place, and not of severe brain contusion; they may be associated with bruising of the brain and extravasation of blood, not sufficient, perhaps, to cause fatal compression of the brain-structure, but enough to set up cerebral symptoms, which cannot pass away for many months under the most favorable conditions; or they may be accompanied by severe brain laceration or extravasation of blood upon or into its structure, which will prove fatal by coma. The position of the extravasation has no influence on the symptoms, although it would appear that death is very rapid when it occurs into the ventricles. The primary symptoms of concussion, when severe, and of general compression are identical; they may both be the result of the same kind of accident, a severe brain shake or injury, and they are often not to be distinguished. "But," says Mr. Hewett, "there is this marked difference: in concussion the effects are instantaneous, and in com-

Diagnosis between concussion and compression.

pression from extravasated blood some little, it may be very short, time elapses before the symptoms manifest themselves; in the former, also, the symptoms gradually pass off, but in the latter they become more and more marked."

"The diagnostic signs of concussion and compression are, no doubt, distinct in a certain sense, yet compression rarely exists as a consequence of violence without concussion, and both are complicated with shock. Further, symptoms of simple concussion may become developed, at a later period, into those which indicate some more serious lesion; and it is in exceptional cases only that we can identify, with any degree of certainty, the efficient and sole cause of compression. Thus, in the stunning effects which succeed a blow on the head, if we can rouse a patient from his state of unconsciousness, even for a few moments, if the breathing is calm and noiseless, if the pulse is feeble, the pupils are contracted and reflex action can be excited, we conclude that the condition is one of concussion. The intensity of the effects of so-called concussion are marked by the character of the symptoms and by their duration. The probable explanation of protracted somnolence and other evidences of brain disturbance is the presence of diffused extravasation of blood over the surface of the hemispheres." (F. Le Gros Clark.)

Hæmorrhage into brain, with fracture.

In a general shaking of the brain, again, blood may be extravasated into the brain itself. When so-called concussion of the brain was considered this point was dwelt upon, but when the injury has been sufficient to produce fracture there is no limit to the amount of hæmorrhage or its seat. "But in dealing with such cases great caution is necessary in order to avoid, if possible, mixing up cases of apoplexy with those of traumatic effusions. An accident coexisting with an extravasation of blood into the cerebral substance does not necessarily imply cause and effect. The previous condition of the brain or the outpouring of blood from diseased vessels may, in fact, have been the cause of the accident." (Hewett.)

On reference to my notes I see that in a case of brain injury which lived only one hour, blood was found filling the ventricles. In another the ventricles were bruised and the septum lucidum was lacerated. In other cases blood was poured out into the thalamus opticus or the corpus striatum.

In all these cases the brain had been severely shaken, and the hæmorrhage was doubtless the result of the shake, the fracture being merely a complication.

General summary.

It has been already shown that concussion of the brain too often implies contusion or laceration of its structure, with extravasation of blood, and in the same way compression involves as serious if not more severe injury. Concussion does not by itself produce definite symptoms, and when paralysis, vertigo, sickness, or other such phenomena, arise, the inference is that there is some structural damage to the brain. Compression implies a more severe degree of the same sort of injury with effusion of blood or depression of bone. Compression of the brain, when not excessive, is seldom the direct cause of death; it proves fatal in the majority of cases by being the starting-point of an intracranial inflammation; for blood, it has been proved, can be absorbed or encysted, and depressed bone may be gradually raised by the brain itself, or the brain may accommodate itself to the pressure.

Compression of the brain, as a result of traumatic encephalitis, will receive attention in another page.

Wounds of the Brain.

Escape of brain through wound. Prognosis.

In some injuries to the skull the brain may be wounded or lacerated, and brain-matter may even escape from the wound directly after the accident. Such accidents are always of a very grave nature, and, as a rule, fatal. Wounds of the anterior and upper portions of the hemispheres are the least dangerous; wounds of the posterior hemisphere or base of the brain are the most so. Recovery may at times follow, even after very severe injuries, when no secondary inflammation takes place; but the prognosis must always be unfavorable.

When brain-matter is pressed out of the skull in cases of fractured base a grave injury is always indicated, for the crushing force must have been severe to have given rise to such a complication. Some remarkable instances of recovery after the escape of brain-matter are recorded; several have passed under my own observation, but they are too rare to be dwelt upon as holding out any hope in bad cases. Foreign bodies may likewise lodge in the skull for a long period without causing death. Wounds of the brain are not characterised by any special symptoms apart from those of concussion or compression.

Wounds of dura mater.

Wounds of the dura mater are probably as dangerous as wounds of the brain, for inflammation of the membranes is readily set up by such injuries. It is from this fact that compound fractures of the skull are so serious; that simple fractures associated with comminution of the inner table of the skull are so often fatal; that punctured fractures have so dangerous a tendency; for in all these cases the dura mater is not only torn, but irritated by the projecting spicula of bone, and secondary inflammation is the result, this inflammation, as a rule, rapidly spreading over the brain and causing death.

Prognosis.

Wounds of the dura mater are, however, recovered from, as are wounds of the brain, but the prognosis in either case must be unfavorable.

Hernia cerebri,

Hernia cerebri and its treatment.

or protrusion of brain-matter mixed with inflammatory products, is always the result of a wound or slough of the dura mater, either secondary to a compound fracture or to the removal of fractured or diseased bone with the trephine. It is, probably, always associated with some suppuration (local) of the brain, due to extension of inflammatory mischief to that part in contact with the diseased dura mater and bone. It is to be treated with great caution; some Surgeons are in the habit of cutting off the projecting mass, others of applying pressure; but probably the best practice lies in doing very little, in keeping the parts clean and dry, and leaving their repair to natural processes; for should the local affection be so limited in its nature as to be capable of repair, the projecting mass will slough naturally after a time, and then cicatrise, but all interference on the part of the Surgeon tends towards harm. The best treatment is to apply a piece of lint to the part at first, and at a later stage to keep the hernia dry by dusting it with oxide of zinc or powdered alum. Excision and the application of caustics or pressure, do not appear to be satisfactory forms of treatment.

The experience of the army Surgeons during the American war confirms these observations.

INFLAMMATION OF THE CRANIAL BONES, BRAIN, AND MEMBRANES, THE RESULT OF AN INJURY TO THE HEAD.

In all cases of injury to the head, simple or severe,—of fracture or no fracture,—of concussion or compression,—of injury to the dura mater or the brain,—inflammation of the bones, of the brain, or of its membranes, is very liable to appear, and in either case is a very grave complication. It is this fact that makes all injuries of the head, even simple contusions of the bone, sources of danger, for inflammation, commencing in the bone, too frequently spreads inwards to the membranes of the brain and the brain itself, and thus destroys life. The free communication between the pericranium and the dura mater, by means of the blood-vessels, through the medium of the diploe of the skull, is a probable explanation of this occurrence in simple scalp and bone contusions. In injuries to the bones of the skull, to the brain or its membranes, the liability to encephalic inflammation appears to be greatly determined by the severity of the accident.

Encephalic inflammation.

In the present chapter, traumatic encephalitis, *acute* and *chronic*, as the result of brain shocks, whether with or without a fracture, will claim attention.

In acute encephalitis the symptoms generally appear on the second or third day following the injury, and pain in the head is the most prominent symptom. The pain may be local or diffused, and is generally accompanied with intolerance of light and contracted pupils, intolerance of sound, and symptoms of febrility. As the disease progresses wakefulness, restlessness, delirium, and convulsions will probably follow; and then the patient will pass more or less rapidly into a comatose condition, from compression of the brain by effusion, and a speedy death will ensue; the effusion taking place into the ventricles, sometimes but more often on the surface or the base of the brain.

Symptoms of acute encephalitis.

In chronic encephalitis the symptoms may show themselves soon after the injury, but, as a rule, they do not appear for weeks, or even months. They are most insidious in their nature; headache of a constant exhausting kind, aggravated by mental or physical exertion, being the most prominent symptom. Want of sleep is a natural consequence, with an irritability of brain and inaptitude for any bodily exertion. The patient gradually becomes emaciated and exhausted, and towards the close of the case epileptiform convulsions, local paralysis, and coma, supervene.

Symptoms of chronic encephalitis.

The *acute* cases, for the most part, are the result of a severe *general* shaking of the brain, with or without fracture, complicated with contusion or laceration of the brain-structure or its membranes; they are consequently cases of arachnitis and inflammation of the brain-substance itself, the inflammation of the membranes being general. "I have never known," says Wilks, "such an affection as arachnitis spring up as a spontaneous disease, and therefore when met with you should always look for some mischief without. When arising in this way, the interarachnoid effusion is often purulent, and so copious that it may pour out when the dura mater is removed. I have never seen extensive effusion into the interarachnoid space without an injury on the head."

Acute, result of general shaking of brain.

Chronic, result of local injury.

Suppuration in brain by extension of inflammation.

The *chronic* cases are for the most part the result of a *local* injury, and begin in the bone, spreading inwards to the dura mater, and at last involving the arachnoid cavity with its two layers of serous membrane, the pia mater, and even the brain itself; local suppuration is frequently found in these cases, either between the bone and dura mater or in the brain itself, from extension of inflammatory action from without inwards, the whole process being in the majority of instances a local one. The same changes take place in all cases of chronic ostitis of the calvarium, whether from accident or disease.

Common cause of death in head injuries. Reaction in excess.

The acute or diffused form of arachnitis is the cause of death in most of the cases of head injury that survive the immediate results of the accident; it comes on in the stage of reaction—indeed, it may be looked upon as reaction in excess—febrile symptoms, convulsions or convulsive twitchings, delirium or mania more or less acute, terminating rapidly in paralysis, coma, and death, being the general sequence of symptoms. Effusion of serum takes place into the ventricles and upon the brain, causing at times compression; or effusion of pus or puriform lymph, occurs either upon the brain itself, or in the meshes of the pia mater, or into the cavity of the arachnoid.

Seat of origin of inflammation.

No indications of seat of inflammation.

Whenever the brain has been severely shaken, and consequently bruised or lacerated, inflammation may appear at the injured spots; thus it at times shows itself *beneath the seat of the blow*, but more frequently it begins at that portion of the brain that has been *bruised or lacerated by contre-coup*, on the opposite side of the brain to the seat of injury; from these centres inflammation may spread to the membranes from the cortical structure of the brain, or within its substance; thus, in all cases of a general shaking of the brain, the seat of inflammation is in most cases at the base. The pia mater and cortical substance of the brain are commonly the seats of inflammation, but the cavity of the arachnoid is likewise involved in many cases secondarily by extension of the morbid action. There are no symptoms by which the precise seat of the inflammation in the brain or its membranes can be made out; they are alike in all cases.

It will be thus seen that the two classes of cases of acute and chronic encephalitis are in a measure distinct. The *acute* is the result of a bruising of the brain by a severe shaking or concussion, that bruising being, as a rule, at the base of the brain by contre-coup; it begins in the pia mater spreads outwards, and is for the most part diffused and not local. It is consequently *beyond* the reach of surgical art.

The *chronic* is generally the result of a local contusion or fracture of the bone, and is local in its action; it involves the dura mater by extension from without, and the arachnoid, pia mater, and brain consecutively in the same way. It is consequently *within* the reach of surgical art.

Treatment of encephalitis.

Treatment.—Acute encephalitis, when following a general injury to the brain, for the most part runs such a rapid course that there is little time for treatment to take effect; it attacks patients, moreover, who have been already knocked down by the injury in more ways than one, in whom there is rarely much resisting force, and there is consequently not much chance of success by treatment.

Head shaved and raised.

Ice to head.

The head must be, of course, shaved and raised on a pillow, and ice applied, for there is no remedy more valuable than the application of ice in traumatic inflammation of the head. The ice must be broken up into small fragments, and the bag containing it should be a large one, to cover the whole vault of the skull. The cold douche is a powerful remedy and has been highly spoken of. Free purging should then be used, the old dose of calomel mixed with butter introduced into the mouth being probably the best form; an enema of turpentine or castor oil aiding the work.

Free purging.

Enema.

With respect to bleeding, much caution is needed. It has been little used of late years in head affections; but in a strong man, when acute encephalitis has come on after a slight injury, it is certainly a sound practice. It should be performed boldly and freely, so as to take effect upon the patient, and at the early part of the disease—during the state of excitement, before brain oppression has appeared, before effusion has taken place. In severe general injuries it is useless. Some Surgeons employ leeching and cupping on the nape of the neck, and speak highly of the practice.

Bleeding.

Calomel, combined or not with opium, and given in small and repeated doses to touch the gums, has its advocates. Patients have, doubtless, recovered under such treatment, and it may still be employed. The grey powder in three- or four-grain doses with five grains of Dover's powder, is a useful combination when delirium is present; and larger doses of opium or morphia may at times be given. Great care must, however, be observed in the use of these drugs, for unless they be carefully given and their effects be watched they are injurious. Opium and its preparations are only of use in the onset of the affection.

Calomel.

The French surgeons still employ blisters to the scalp, but these cannot in value be compared with the local application of ice in the onset of the disease; in the chronic stage they may be of use. They should be applied to the nape of the neck. When blisters are employed and mercury is given, it may be used in the form of an ointment to dress the blister. Antimony is still given by some surgeons of eminence. I have no experience of its use, and cannot recommend it. When recovery takes place—a rare result—the patient must be cautioned as to the future, for any excess of diet or of mental or physical exercise may bring on a relapse. The greatest quiet ought to be observed for many weeks, and the patient ought to live on the simplest food. Milk diet and animal broths are sufficient for some time, animal food being taken with great caution. Stimulants should be only allowed if the patient's powers are feeble.

Blisters.

Diet.

Rest.

When indications of compression of the brain follow these inflammatory symptoms other treatment may be called for, but only when strong evidence of local compression exists.

Compression of brain from local suppuration.

When the symptoms are the result of acute encephalitis, and, consequently, of a general injury or shaking of the brain, there is little doubt that the compression of the brain is due to effusion of inflammatory fluid into the ventricles, or upon or beneath the brain, and under such circumstances the question of surgical interference cannot be entertained. It is to be thought of only in cases of local suppuration, and these, as it has been already shown, are the result of a local contusion of the bone, of injury, or disease, and the symptoms are, as a rule, of a chronic nature. The seat of suppuration under these circumstances is usually between the bone and the dura mater, but at times a local abscess is formed in the cavity of the arachnoid; when strong evidence of this condition exists, the parietal layer may be punctured, good results having followed this practice.

Puncturing the brain for suppuration.

In more advanced cases, suppuration may even involve the brain itself; and it is a serious question whether a Surgeon is ever justified in puncturing this organ with a view of laying open the suppurating cavity. Should good evidence exist of suppuration in the cerebral hemisphere beneath the seat of injury, it is quite possible the Surgeon might be justified in making an exploratory puncture, for cases are recorded in which such a practice was successful, but the evidence must indeed be strong to justify such a measure. Dupuytren had a successful case of the kind, and pathological anatomy furnishes examples in which such a practice might have been of use. On the other hand, many bold attempts are on record in which Surgeons have punctured the brain to relieve symptoms of suspected suppuration in its substance, but without success. Perhaps the boldest is by Dr. Detmold, of America. ('Amer. Journ. of Med. Science,' No. 37.)

Still, in these cases much may be done—more, indeed, than is usually done—for the relief of symptoms, and I am disposed to think that Surgeons are too apt to leave these cases alone too long, and allow them to get beyond relief.

Symptoms of local ostitis after contusion of cranium.

A man receives a blow upon the head, followed by passing symptoms of so-called concussion; he has a slow convalescence, attended, and perhaps followed, by headache. He may display some irritability of brain, inability to do much work, or to undergo any physical fatigue; some febrile disturbance may perhaps manifest itself, but as often as not none appears. The pulse will probably be feeble and irritable, at other times slow and labouring. On examining the seat of injury some tenderness on pressure may be experienced, and at times increase of heat will be felt. I have known pressure upon the injured part excite a convulsion where such had previously occurred.

Treatment by free incision.

Under these circumstances, fairly indicative of local inflammation of the bone, spreading inwards—but how far is uncertain—a free incision down to the bone is of great value. I have known this operation relieve all the symptoms, general and local, at once, and I have never known it followed by harm. When evidence of local inflammation exists, with undefined and persistent brain symptoms, it should be performed.

Symptoms of abscess beneath bone.

When evidence exists that this inflammation has spread from the bone to the parts beneath, as indicated by marked symptoms of feverishness, severe headache, and probably rigors; with sleeplessness, delirium, convulsions, and paralysis, particularly when hemiplegic, other surgical treatment may be thought of; for if these symptoms are associated with such a history as has just been sketched there is every probability that suppuration exists within the skull, and that surgical art may reach it. General treatment in these cases is both unsatisfactory and unsuccessful; and if the case be left alone bad results always follow. Surgical interference, it is true, is as a rule not very satisfactory, still some striking examples of success exist. In the hands of Pott, trephining the skull for matter beneath the bone outside the dura mater yielded a good result in five out of eight cases. It is true no modern Surgeon can show a like success; "indeed," says Mr. Hewett, "the successful issue of a case of trephining for matter between the bone and dura mater is, I believe, all but unknown to Surgeons of our

Question of trephining.

own time." Nevertheless, the operation is clearly a justifiable one under such severe circumstances as have been enumerated; although I cannot help feeling that Mr. Hewett's opinion is true, and that Surgeons are too much disposed in these cases of local encephalitis to wait too long, to trust too far to nature's own processes, and by so doing to allow the local suppurative action to spread inwards beyond the dura mater to the brain itself, when the prospects of a successful result are certainly poor. They wait for what are called well-marked brain symptoms—coma and hemiplegia—before they interfere; these well-marked symptoms too often meaning fatal brain complications in the disease. Nevertheless, trephining the seat of injury under such circumstances is clearly justifiable, if not hopeful, and the operation should be performed as soon as it is manifest from the history of the case that the local action is spreading. When pus is found between the bone and the dura mater good hopes may be entertained of a successful issue, although when the same suppurative action has involved the cavity of the arachnoid and the brain, the prospect is not a good one.

Necessity of early interference.

Should, however, no pus be found between the bone and dura mater, is the Surgeon justified in opening the membranes? Without doubt he is under certain circumstances, when by the symptoms there is strong reason to believe that pus exists beneath the injured bone; when the dura mater on exposure *bulges* firmly into the opening in the bone which the Surgeon has made with his trephine, and if it be *tense*, and absolutely *pulseless*; for cases of success after this operation have been recorded by Guthrie, Roux, and Dumville. The evidence required to sanction any incision into the brain in search of suppuration, as has been already stated, must, however, be very strong; I have never seen an instance in which it was justifiable.

Puncturing dura mater in suppuration.

Symptoms justifying such a step.

Acute encephalitis, as a result of blood-poisoning, needs only to be mentioned. It is a hopeless case as far as the Surgeon is concerned, and is always associated with the worst and most general form of pyæmia.

Encephalitis as result of pyæmia.

TREATMENT OF CONCUSSION AND COMPRESSION OF THE BRAIN, AND OF FRACTURES OF THE SKULL.

"A mere crack in one of the bones of the cranium, *abstractedly considered*, is not more likely to produce any serious complaints than a simple fissure in any other bone; and if symptoms of consequence do frequently attend the accident, they proceed either from the bone being beaten inwards, so as to press upon the brain, or from the mischief done to the parts within the skull by the same force that broke the bone itself. The same violence which breaks the cranium may occasion a concussion of the brain, an extravasation of blood in or upon it, or subsequent inflammation of that organ and its usual consequences." (Sam. Cooper.)

General remarks.

The truth embodied in this extract renders it necessary to consider the treatment of head injuries as a whole; for it is impossible, in any case of severe injury to the skull, to say whether two or more of the conditions mentioned are not associated.

When so-called concussion has taken place, it may or may not be associated with fracture; it may or may not be followed by symptoms of compression, either from extravasation of blood or secondary inflam-

Treatment in early stage to be expectant.

mation. When a fracture is known to exist, either with or without depression of bone, the difficulty is not lessened; the brain symptoms may be simply those of a passing concussion, but they may be those of a much more serious injury—of brain contusion, laceration, or blood extravasation. The severest complications are often ushered in by the mildest symptoms; as a consequence, it behoves the Surgeon always to treat every case of injury of the cranium and its contents as a serious one, and to be as guarded in his prognosis as he must be uncertain in his diagnosis. "We know not what injury may have been sustained or what symptoms may supervene; we therefore wait for the subsidence of the first impressions, or the development of fresh mischief, and shape our course accordingly." (Cock.)

Treatment of mild case of concussion.

In any case, therefore, of so-called concussion, however slight, the patient ought to be kept quiet for a few days, and ought to observe moderation in diet, particularly in the use of stimulants. If he goes about he does it at a risk—a risk of secondary inflammation of the concussed or shaken brain, which may prove fatal.

Of severe concussion.

Collapse.

Caution in hastening reaction.

Avoid alcoholic stimulants.

In severe concussion, that is, after any injury to the head which is followed by a more or less complete suspension of the functions of the brain, whether with or without a fracture, equal care is needed. Should the collapse indicative of the first stage be severe, it may be necessary for the Surgeon to hasten reaction by means of warmth to the body generally, and more particularly to the feet, and by the application of some stimulant to the nostrils. It is seldom right to do more than this; for if reaction does not reappear naturally, or is not hastened by the means mentioned, it is tolerably certain that the brain mischief is of a severe if not fatal character; and under these circumstances, any more powerful means, such as the administration of alcoholic stimulants or powerful enemata, are likely to excite reaction to excess, and thus encourage secondary hæmorrhage or inflammation within the skull.

Reaction, and its treatment.

When *reaction* has set in after the collapse—the *second stage* of authors—every source of excitement, mental or physical, should be removed. The patient should be kept in bed with his head raised and shaved. The bowels should be emptied with a mild saline purgative, or a mercurial purge. If the head be hot, the pulse rapid, and other symptoms of general febrility and brain excitement show themselves, cold lotions or the ice-bag may be applied, the latter particularly. When the symptoms of reaction in excess are marked and persistent, the commencement of traumatic encephalitis should be suspected; and under such circumstances active treatment is doubtless required, for when acute symptoms of inflammation of the brain or its membranes appear paralysis and a fatal coma are not far off.

Venesection.

Venesection boldly performed at this stage of the disease, so as to affect the pulse, is a good practice. It may even be repeated should the symptoms return and the pulse and temperature rise. This practice is, however, only to be carried out after careful consideration.

Cold to head.

In feeble patients bleeding is inadmissible. Ice to the head or a stream of cold water passed over it are means that ought never to be neglected. Powerful purgation, also, is a valuable practice. The diet must be liquid and of a simple character. Milk, when it can be taken, is the best food, but when it cannot, beef-tea or broth should be given, and these in moderation.

Concussion of the brain, complicated with undepressed fracture, simple or compound, is to be treated upon like principles, with equal persistency and care. Fractures of the base, also, with concussion, are amenable to the same means; for simple fractures of the vault, compound fractures of the vault, and simple fractures of the base or vault and base combined, *unassociated with displacement*, have no special treatment beyond that indicated by the brain symptoms.

It should be stated here that the treatment of all these cases is to be continued for at least a month or six weeks after the injury, for many are the cases on record in which secondary inflammatory symptoms appeared at least a month after the accident or after the subsidence of the primary symptoms.

Treatment of compression.

Treatment of compression.—When the brain symptoms following an injury to the head partake more of the nature of compression; that is, when they are persistent in their character, and, instead of going on towards a recovery or restoration of the natural functions of the brain, tend rather towards their more complete abeyance; other important questions of treatment come before the Surgeon, and the most important one has reference to the point whether surgical art can do anything towards relieving the condition.

Surgical interference useless in general injuries of the cranium and its contents.

The student who has carefully read the remarks that have been previously made will readily understand, when the injury to the brain or skull has been the result of some *general injury*, such as a fall upon the head from a height, or a blow from a heavy body, that the brain mischief which follows is certain to be of a general character, and beyond the hope of relief from surgical skill. Should symptoms of local mischief be associated with the case, they will be only part and parcel of a general injury, and no permanent good will accrue from their special treatment; for when a bone of the skull is depressed, or symptoms indicate extravasation of blood between the bone and the dura mater, as a consequence of some severe general injury to the skull contents, there is little use in treating these local symptoms when others of a more general or fatal character exist. In examples of brain or skull injury, therefore, as a result of diffused or general shaking of the head and its contents, local interference of any special character is useless.

Surgical interference justifiable in local injuries of the skull and its contents.

In *local* injuries the question may be seriously discussed, for it is in such, and in such alone, that any good result can be looked for.

Depressed fracture.

In cases of *depressed fracture*, ought the bone to be elevated? Should the fact of the fracture being compound influence the decision? I have little hesitation in answering both these questions, and asserting that in neither instance ought surgical interference to be thought of unless the symptoms of compression are very marked or very persistent; for experience has taught us that depressed bone *per se* may exist to a great degree without giving rise to any serious brain complications, and that even when brain symptoms follow as an immediate result of the injury, they may all pass away.

Extravasation of blood between bone and dura mater.

Should the symptoms indicate the presence of effused blood beneath the fracture, sufficient to cause compression of the brain, as shown by the "interval of time" between the accident and the symptoms; and should local paralysis point out its seat; surgical interference is justifiable and called for. The trephine should be employed to elevate the bone under these circumstances in both simple and compound fractures. The operation is necessary on account of the brain symptoms present in the case, and has no reference to the character of the local injury,—to the presence or absence of a scalp wound.

In comminuted compound depressed fracture remove fragments and elevate.

In *compound fracture* of the skull, however, associated with *depression and comminution* of the bone, both with or without brain symptoms, the Surgeon ought to remove loose pieces of bone, and may elevate the depressed portions when this can be done with the elevator without difficulty, for splintered bone is always a dangerous body when in contact with the dura mater.

When the brain is injured the same practice should be followed, the greatest care being observed in not adding to the irritation by any rough manipulation; indeed, should difficulty be felt in removing bone it had better be left *in sitû* rather than incur any extra risk of injuring the brain or its membranes by interference.

Should severe hæmorrhage take place from a meningeal artery in displacing bone, the piece should be left; and should this practice fail to arrest it, a small piece of sponge tucked in beneath the bone may answer, or the application of a small pair of spring forceps may be called for; it is not often, however, that such a complication is met with.

In all cases of *punctured fracture* of the skull trephining should be employed.

General summary as to surgical interference.

It would thus appear that in simple or compound *uncomminuted* depressed fracture from a local injury no operative interference is called for, unless associated with marked symptoms of compression of the brain, or extravasation of blood between the bone and the dura mater. In compound *comminuted* fracture, and in *punctured* fracture, with or without symptoms of brain compression, it is wise to elevate the bone and remove all fragments. In all other cases, as in fracture of the base, no surgical interference can be justified.

Did space permit, many cases might be quoted to illustrate these points. Cases of fracture of the skull, depressed bone, and recovery, are numerous; indeed, it is most remarkable how much depression of the bone may exist without giving rise to brain symptoms, and I am almost tempted to believe that depressed bone by itself never gives rise to marked symptoms of compression, and that when these are present hæmorrhage exists with it.

Cases in elucidation.

Many cases might also be quoted illustrating the value of surgical interference in compound fractures with depression; I give the following:

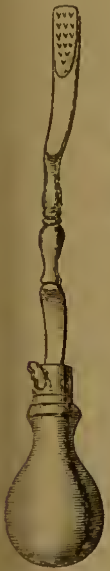
Compound fracture of skull with depression from local injury. A feeling of permanent weight on the head was the only symptom. This was at once relieved by removal of the bone, and recovery followed.

Compound fracture of skull with depressed bone from local injury. Constant vomiting, and pain in the head. Relieved at once by removal of the bone; recovery on the fourth day.

Compound fracture of skull with depressed bone from local injury. Persistence of symptoms of oppressed brain. Elevation of depressed bone; rapid recovery.

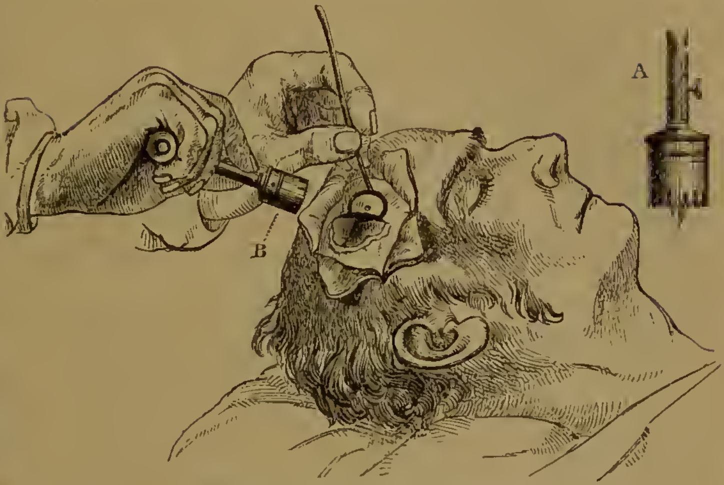
THE OPERATION OF TREPHINING.

Fig. 61a.



Elevator.

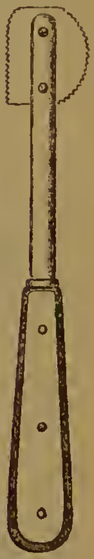
Fig. 60.



Showing the operation of trephining.

A. Trephine prepared for use, with centre pin down.
B. With centre pin withdrawn, the outer table having been divided.

Fig. 61b.



Hey's saw.

"Much has been written and said on the treatment of injuries to the head; and the result of modern experience and judgment has so far altered the practice of our predecessors, as to render us cautious of inflicting an additional injury on our patient for the sake of gratifying an impertinent and useless curiosity as to the exact nature and extent of the original lesion." Thus wrote my colleague, Mr. Cock, nearly thirty years ago, and what he then said is as true now, although, perhaps, Surgeons at the present day are less disposed to trephine in head injuries than they were even then.

Statistics.

At Guy's Hospital trephining and elevation of bone for head injuries have been performed in fifty-one cases during seven years, and of these cases twelve recovered. At St. Bartholomew's Hospital it was recorded by Callender in 1867 that the operation had not been performed for six years. At University College, Erichsen gives six cases of recovery out of seventeen.

I propose now to consider under what circumstances the operation should be performed.

The operation is likely to be of use in two classes of cases:

Circumstances under which trephining may be of use.

First.—To relieve compression of the brain from depressed bone or from extravasation of blood.

Secondly.—To prevent, check, or relieve irritation of the brain or its membranes when caused by (1) depressed and comminuted bone, by (2) inflamed and swollen bone (whether the result of accident or disease), or by (3) an accumulation of pus between the bone and dura mater compressing the brain; and it may be stated at once that the operation of trephining gains more support from the second group of cases than from the first.

Trephining for depressed bone or extravasation rarely wanted.

With respect to the first class of cases it will have been gathered from former chapters that depression of the bones of the skull is rarely sufficient of itself to give rise to persistent symptoms of compression, and that when it is, the injury has probably been of so severe a nature as to produce grave intracranial complications, to which any operation would be incapable of affording relief; and that hæmorrhage between the bone and the dura mater is rarely so uncomplicated with brain mischief as to render it probable that the operation of trephining will be a practical success.

Only justifiable when the symptoms are very marked.

When, however, it can be fairly determined that brain symptoms of a defined and aggravated character are the result of either of these two causes, separately or combined, the operation of trephining may be performed. In diffused injuries to the skull the probabilities are all against the operation; in local injuries they are in its favour.

These observations are particularly applicable to all cases of simple fracture of the skull, with or without depression.

Elevation of depressed bone in compound fractures.

They are also as applicable in compound fractures when the operation of trephining is being considered for the relief of the immediate results of an injury; for in compound, as in simple, fractures, the depressed bone rarely causes symptoms of compression; and extravasation of blood outside the dura mater, sufficient to give rise to symptoms, is not often found. But still, in these cases the elevation of the bone, when depressed, the removal of fragments, when comminuted, either by the trephine or other means, is, without doubt, a valuable practice; the object being under these circumstances to *prevent*, at an early period of the case, and to *check* or *relieve* at a later period, irritation of the membranes and of the brain, which is so liable to pass on to traumatic encephalitis.

Remove fragments of bone.

It would thus appear that in both simple and compound fractures of the skull, with or without depression of bone, the symptoms of compression of the brain, as a primary result of the accident, must be very marked indeed to justify the operation of trephining; but that in *compound fractures* it is expedient to elevate depressed bone, when any symptoms of brain irritation manifest themselves, such as local pain and weight, spasms or convulsions; and under all circumstances that it is best to remove fragments when the bone is comminuted, this practice agreeing with the principles that should influence the Surgeon in the treatment of simple fractures. Trephining in the one case is negatived on the principle that it would only be an additional source of irritation to the membranes of the brain, and is suggested in the other to remove definite sources of irritation that are prone to produce encephalitis, without adding in any way to the danger; for in a compound comminuted fracture of the skull the dura mater is probably exposed, and is likewise irritated by the broken bone. A careful elevation of the depressed portion of bone and removal of the comminuted fragments can in no way add to the mischief, and must tend towards its diminution.

Trephine when incipient symptoms of encephalitis exist.

In *local injuries,* whether simple or compound, when incipient symptoms of brain irritation or inflammation appear two or three days after the injury, the use of the trephine is indicated, for there is a probability that the symptoms originate in the presence of a fragment of bone irritating the brain or its membranes, which if left will go on to set up encephalitis.

In all cases of *punctured fracture* the trephine should be employed.

In *diffused injuries* to the cranium and its contents all interference is unjustifiable.

Pus between dura mater and bone.

When pus can be made out to exist between the bone and the dura mater after a head injury, the operation of trephining is demanded, but the diagnosis of such cases is a task of difficulty. The chief indications are found in the prolonged period which frequently elapses between the injury and the supervention of the symptoms, their gradual and, it may be said, irregular approach, the general and cerebral irritation that is, as a rule, present, and the exacerbation of all these symptoms, but, above all, the constant headache.

The direct symptoms of compression produced by the formation of pus are, moreover, in no ways so definite as those afforded by blood extravasation; they are of a less decided nature, and are never associated with the deep-toned stertor and rapid progress of the symptoms, "which, with overwhelming influence, quickly annihilate both motion and consciousness when blood has been poured out in any considerable quantity after injury to the cranium." (Cock.) They are, however, fairly marked by the clinical history of the case, and can be generally recognised.

The operation of trephining.

Instruments required.

The instruments required for the operation are the *trephine*, or circular hand-saw, of which there are two sizes; a *small saw*, with a straight and circular edge, generally known as Hey's saw; a *sharp scalpel*, with a handle rounded at the end, to press back the periosteum and soft parts from the bone; a *flat probe*, thin enough to introduce into the groove made by the trephine, to guide the Surgeon in his attempt to perforate the bone, and to prevent him going too far; a pair of *cutting forceps*, to remove sharp points and edges of bone; *an elevator*, to raise depressed bone; and dissecting, dressing, and torsion forceps. (*Vide* Figs. 60, 61A, and 61B.)

Position of patient.

The patient's head having been placed upon a pillow, *shaved*, and held firmly, the first thing the Surgeon has to do is to expose the bone he wishes to perforate or elevate. This must be done freely, either by enlarging the wound that previously existed or by a crucial incision.

Incision.

The soft parts should be divided by one cut down to the bone, and these, including the periosteum, should be gently pressed back with the handle of the knife. Bleeding at this stage should be arrested by ligatures, torsion, or the application of a cold sponge and pressure.

Supposing the case to be one of fracture with depression, and that fragments of bone exist, they should be removed, great care being taken in their removal not to twist the broken bone, and thus run the risk of tearing the dura mater; should an opening thus be formed, the depressed bone may be raised by means of the elevator carefully introduced beneath its free border. To facilitate this proceeding, perhaps the removal of a piece of projecting bone by forceps or Hey's saw will be found of use, and if so the trephine is not required; for the Surgeon's object, under these circumstances—to raise the depressed bone and remove the comminuted portions—may be completed without the trephine.

Should the bone, however, be so depressed as not to present an edge for the Surgeon's forceps, as is seen in the "gutter" fracture illustrated in Fig. 53, the trephine must be employed. The instrument should be previously prepared, and the central pin made to project sufficiently far to perforate the external table, and fixed to allow the saw to bite the bone. (Fig. 60 A.) In a depressed fracture this pin *should never be placed upon the fractured bone*, but upon the border of the sound bone. The instrument is then to be applied, and the external table cautiously divided with a few semi-rotatory movements of the Surgeon's wrist. A groove having been made deep enough to allow the saw to work steadily, the instrument is to be removed and the central pin withdrawn and fixed (Fig. 60 B), for it would be a fatal error to go on working with the pin projecting through the inner plate of bone into the dura mater. The Surgeon is now to proceed with the utmost caution; he is to feel his way every few turns with the flat probe, for as soon as he has divided or even reached the inner plate the elevator may be employed and the loose ring of bone removed. Where the inner plate is fractured to a greater extent than the outer, it may not be necessary to divide it, the removal of the external table with the diploe being enough to allow of the introduction of the elevator, and the elevation of the depressed inner table or the removal of fragments. Should this, however, not be the case, the inner table must be perforated, although with the greatest caution, for it is to be remembered that the calvaria is thicker in some portions than others. The whole thickness of the bone must be removed.

Care in perforating inner table.

The operator cannot be too careful in this stage of the operation; he should always proceed with the conviction that the bone is thinner at one spot than at another, and that "there is only the thinness of paper between eternity and his instrument." (Sir A. Cooper's MS. Lectures.) The depressed bone may then be raised by the elevator.

Should the operation have been performed for extravasation of blood beneath the bone, and a clot be discovered, it should be turned out; the utmost gentleness being observed. Should pus exist, it will escape naturally.

After-hæmorrhage.

Should troublesome hæmorrhage from a meningeal artery take place, it may be arrested by tucking a small portion of sponge or a small piece of wool beneath the vessel and compressing it against the bone, or it may be held by a short pair of spring forceps against the bone. But free bleeding from this source is not frequent.

On puncturing the dura mater.

Should, however, no blood or pus be found external to the dura mater, and strong evidence exist that it is placed beneath this membrane, the dura mater may be punctured. This step, however, is not to be undertaken without grave consideration. But, it may be asked, if the operation fail in its object, is the operator ever justified in making a second opening into the skull, in search of blood or of pus? Certainly not at a hazard, it must be answered, although when evidence points to a second position in which it is reasonably probable that the offending fluid may be found, a second perforation may be performed; for cases are on record in which three or more pieces have been removed with a good result.

On making a second opening in the skull.

After-treatment.

The wound, after the operation, must be treated on general principles; the edges may be gently brought together, but not stitched; water dressing is the best application, and the head should be kept cool by the ice-bag. Should the parts heal, and the case do well, a metallic shield will probably be required as a protection, although it is interesting to see how firm the membrane that fills in the cavity becomes after a time.

Hernia cerebri.

Should a hernia of the brain follow at a later stage, the same local treatment is to be employed. Excision of the projecting fungous mass is a practice which cannot be advised. The whole thing will probably wither by natural processes when a cure is to take place, and the less the Surgeon interferes the better.

General Conclusions on Injuries of the Head and their Treatment.

1. Injuries of the head are of importance only so far as they involve the cranial contents, a simple uncomplicated case of fracture of the skull being of less danger than a general concussion of the brain.

2. A slight concussion of the brain, associated or not with a fracture of the vault or the base of the skull, which manifests itself by a slight or passing suspension of the cerebral functions, generally does well.

3. A severe concussion or shaking of the brain, associated or not with a fracture of the vault or the base of the skull, is liable to produce contusion or laceration of the brain substance, either upon its surface or within its ventricles, with more or less extravasation of blood, and when the vessels are diseased, a copious hæmorrhage often follows a slight injury.

4. In cases of severe concussion of the brain the cerebral structure is at least as much injured by *contre-coup* as at the seat of injury, the base of the brain suffering the most. Fracture by *contre-coup* does not take place.

5. A fall upon the vertex from a height, or a blow upon the head from a blunt instrument, may be followed by fracture of the skull, or not; such an accident produces, as a rule, a general concussion of the brain, with such complications as contusion or laceration of the brain and effusion of blood either upon its surface or within the ventricles.

6. Falls upon a pointed object, and blows with a sharp instrument, are, as a rule, followed by a local fracture; and if the brain be injured, it is at the seat of injury. As a consequence, the symptoms may be accounted for by local causes only, and the surgical treatment should be directed by local considerations.

7. When symptoms of compression of the brain immediately follow an injury to the skull produced by a fall from a height, or a blow from a heavy and blunt instrument, the cerebral injury will be general, the brain contused and lacerated, particularly at the base by *contre-coup*, and if extravasated blood be found external to the dura mater, blood will also be found upon the surface of the brain, or within its membranes.

8. If symptoms of compression of the brain follow a local injury produced by a fall upon a sharp object, or a quick blow from a pointed one, such symptoms, as a rule, are produced by local causes, such as depressed bone, or extravasation of blood from rupture of the middle meningeal artery, and such local injuries should be treated by the elevation of the depressed bone or by trephining.

9. When compression of the brain follows a local injury over the course of the meningeal artery, the symptoms coming on after reaction has been established, and the lapse of an interval of time from the receipt of the injury, although no depressed bone be present, the

the operation of trephining may be performed, the blood often, however, passing downwards towards the base of the brain, beyond the reach of the operator.

10. When compression of the brain follows, as a secondary result, a general injury—although that compression is evidently produced by extravasation of blood—the operation of trephining is useless, if not injurious; for although blood may be effused from rupture of a meningeal artery, there will certainly be found some contusion or laceration of the brain itself, or extravasation beneath its membranes, which the operation cannot relieve.

11. Encephalic inflammation may follow any concussion or injury to the brain, however slight, whether complicated with fracture or not; and the danger of such a result is in proportion to the encephalic injury. In cases of contusion or laceration of the brain, with extravasation of blood, it is almost sure to follow, and, as a rule, will produce a fatal termination. This inflammation may appear within a few hours of the accident, or it may be postponed for some days; it may be very rapid in its course, or very insidious in its nature. If the brain alone be affected, either a diffused or local abscess may result; but if the membranes are involved, effusion, convulsions, general or partial paralysis, coma, and death, will rapidly take place.

12. The operation of trephining is perfectly useless in cases of severe concussion of the brain, whether associated or not with fracture, although it may relieve compression arising from local conditions; for the brain is generally injured by *contre-coup* at its base, or in positions where an operation can be of no benefit, but must prove injurious.

13. The operation of trephining is of great value in local injuries to the skull, when associated with symptoms of compression from depression of bone, or the local extravasation of blood between the bone and the dura mater. It is useful also in gutter fractures with comminution of bone, and when a piece of bone has been driven in by a punctured wound.

14. Fractures of the base of the skull may take place alone, and be marked by only special symptoms; they may be associated with, and are generally found in, all cases of severe fracture of the vault, when produced by a heavy fall or blow, the fissures radiating downwards in a direction parallel to the forces employed.

15. Fractures of the base may be complicated with encephalic injuries similar to fractures of the vault, and may consequently be manifested by general as well as special symptoms; in severe cases the former completely masking the latter. The injury, however, may generally be diagnosed, the mode of its occurrence indicating the probability of its nature.

16. All injuries to the head should be treated with extreme care and regarded as serious. Rest in the horizontal posture, freedom from excitement, bland, nutritious, unstimulating food, are essentials under all circumstances, the great principle of practice being to ward off excess of reaction or inflammation of the cranial contents.

DISEASES OF THE SCALP AND CRANIUM.

Besides the blood tumours of the scalp to which attention has been already directed, the head is very frequently the seat of the common skin or *sebaceous tumour;* indeed, these morbid growths are more frequently found on the head than on any other part of the body; they are more common in women than in men, and are often called "wens;" out of one hundred and seven consecutive cases of sebaceous cysts which I have analysed, seventy were in women and eighty-four were on the head. In many instances they are doubtless due to an obstruction of the duct of a sebaceous follicle, for the orifice of the duct is often visible, and through it the contents of the cyst can be squeezed; but in others no such obstruction can be made out, and it is probable that some of these tumours are new formations—true adenoid tumours of the skin. In such the tumour lies beneath the skin, but has no connection with it. In *congenital* sebaceous tumours, this position is very common, although perhaps the cyst is more frequently situated beneath the fascia, or even the muscles, of the part. When about the orbit—their most common seat—these cysts are always deeply placed, and have often close connection with the periosteum. They, moreover, almost always contain hair. By their pressure upon the bone they at times cause its absorption and perforation. The contents of these cysts vary; in some the secretion is milky, in others more solid and cheesy; in some, again, the contents are cretaceous. When degenerating, they may be filled with a blood-stained blackish fluid, and at times they are most offensive, having a peculiar sour smell.

Wens or sebaceous tumours of the scalp.

In neglected examples of this disease the contents of the tumour may soften down, and, causing suppuration, escape externally by ulceration. From the inner surface of these evacuated cysts a new growth may spring up, of a peculiar nature; and this, forming an irregular, fungating, bleeding surface, at times puts on an appearance which has been mistaken for cancer. On examining the edges of the wound, however, this mistake can hardly be persisted in, for it will be at once observed that the edges of the wound are healthy, and not infiltrated with new matter, as would be the case in cancer, this irregular fungating growth consisting of exuberant granulations from the cyst itself. Abernethy described these growths years ago, but in more modern times the best account is given by Mr. Cock, in 'Guy's Hosp. Reports,' 1852.

Ulcerating follicular tumours.

Simulates cancer.

In other cases, again, a horny growth springs up from the interior of the cyst. These points are illustrated in Fig. 10, p. 105, taken from the head of a man æt. 70, upon which were wens of different sizes and a horn of twenty-one years' growth.

Treatment.—The only correct treatment of these cysts, whether whole or broken, is their removal by excision. It is needless to be too careful in dissecting the cyst out entire, as was formerly done, the most expeditious method being to slit open the tumour with a bistoury, and turn it out with the forceps or handle of a knife. This plan is rapid and effective, and far superior to the older and unnecessary one of a steady dissection. In children, however, the cysts may frequently be squeezed out of their bed by the thumb and finger.

Treatment.

It is common to hear of the danger of erysipelas after these excisions, but such a fear is groundless. The excision of the congenital tumour is sometimes difficult on account of its close attachments, and unless all the cyst is removed a return of the growth may be looked for. Some Surgeons consequently advise the careful dissection of the cyst; I have generally found, however, a free incision into it, and the removal of its walls by the scalpel or scissors, sufficient.

The scalp may likewise be the seat of other tumours, *simple* or

Other tumours.

malignant, of *epithelial* cancer of the skin, or of any other affection of the integument; but these cases require no special attention here.

Nævi.

Nævi are very common in all their forms—cutaneous, subcutaneous, or mixed. This subject will be considered in another chapter. But let me caution the student not to adopt any surgical proceedings with any nævus situated over a fontanelle, for I have known a fatal inflammation attack the membranes of the brain after the application of a ligature to an undoubted cutaneous nævus placed over this region. Let him wait if possible till the bones have closed before he interferes.

Perforating tumours of skull.

Perforating tumours of the skull occasionally come under the Surgeon's notice, and demand attention. The majority have their origin from the membranes covering the brain, and mainly from the dura mater. They are generally *cancerous*, and are often secondary deposits; occasionally, however, they seem to be of the "*fibroplastic*" nature. They were first described by Louis in 1774, under the term "fungus of the dura mater" ('Mém. de l'Acad. Roy. de Chir.,' tome v), and since his day all perforating tumours of the skull have been included under this heading: it must be remembered that a tumour growing within the skull, and pressing outwards, will cause absorption of the cranial bones, and this fact is rendered familiar to pathologists by the enlargement of the Pacchionian bodies.

Symptoms.

The symptoms indicating the presence of this affection are very uncertain—headache, more or less constant and severe, may exist with epileptiform convulsions and other brain symptoms; but, as often as not, the first marked condition to which the patient's attention is directed is a swelling in one of the bones, the disease having progressed thus far without giving rise to any symptoms whatever. When the diseased mass has perforated the bone the swelling will be a pulsatile one, receiving its impulse from the brain, and this symptom is of importance, as a distinctive one between tumours of the bone itself and the perforating tumours of the membranes. In cancerous disease the bone itself will be infiltrated with cancerous elements and destroyed, while in benign tumours the bone will be absorbed simply by pressure, as is seen in aneurism. In the former case the opening in the bone will be ill defined and irregular, in the latter it will be smooth and regular.

Distinction between cranial and intracranial tumours.

Treatment.

With respect to treatment, it is almost needless to say that nothing can be done by way of removal of the growth. The symptoms it causes can only be relieved by sedatives, and life can be prolonged only by general treatment.

The bones of the skull are liable to tumours, cancerous or benign, to exostoses, particularly of the ivory kind, and to myeloid growths; but in this place it is only necessary to mention the fact.

Meningocele and Encephalocele.

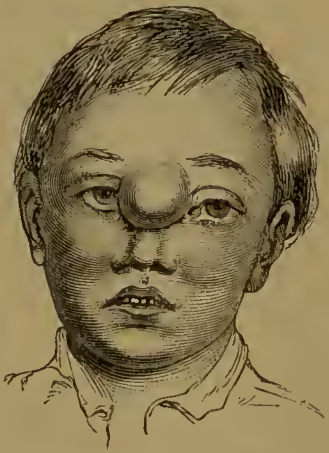
Meningocele and Encephalocele.

These terms are applied to conditions of the head in children at the time of birth, and infants thus affected are generally hydrocephalic. The words indicate a protrusion through the skull either of the membranes of the brain or of the brain itself, forming an elastic tumour. This protrusion generally takes place in the line of one of the sutures. Such cases are always associated with some deficiency of the bones of the skull, it may be of some portion of the frontal bone, near the root of the nose (Fig. 62) or near its external angular process, but by far the most frequently of the occipital bone. In rare examples the deficiency may be at the base of the skull. Dr. Lichtenberg has recorded, in the 'Transactions of the Pathological Society,' vol. xviii, a case in which the tumour was hanging out of the child's mouth, and communicating with the skull through an opening in front of the sella turcica.

Varieties.

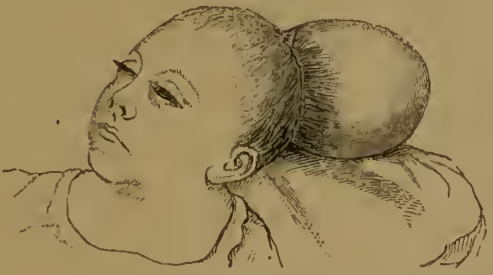
In a *meningocele* the membranes, as a whole, may protrude; but sometimes the dura mater alone projects (*vide* Prep. 1563^{60}, Guy's Museum). In the true *encephalocele,* the brain itself is pressed out of the skull into the external tumour. This was well seen in a patient of Dr. Lever's, from whom the accompanying drawing (Fig. 63) was taken, for the skull contained the anterior and part of the middle lobes of the brain and the sac the remaining portions. The ventricles were likewise divided between the two. The posterior lobes were adherent to the membranes that formed the sac. In a *hydrencephalocele,* in addition to the brain substance, there will be a portion of one or both of the ventricles filled with fluid.

Fig. 62.



Meningocele at root of nose. (Mr. Poland's case.)

Fig. 63.



Encephalocele.
(Drawing 501^{30}, Guy's Hosp. Mus.)

"An *encephalocele,*" writes Mr. P. Hewett ('St. George's Hosp. Rep.,' vol. vi), "is of a round or oval shape; in size it seldom exceeds that of a small orange; its attachment is broad; the integuments covering it present little or no alteration. In the earlier periods it has the characteristics of a watery bag; but later on, as the fluid gradually disappears, the brain matter fills the sac, and then the tumour becomes soft and doughy."

A *hydrencephalocele* "in shape is more or less pyriform, with a marked contraction at its attachment, sometimes a long and narrow stem; in size it is apt to become much larger than an encephalocele.

The integuments over it are thinner, fluctuation exists about the hernia, and large veins may be traced under the skin."

May simulate a cystic tumour.

Natural cure.

Treatment.

When these tumours are small, and have a very minute communication with the cranial contents, they have been and may be again mistaken for some simple cyst or tumour. The Surgeon should, however, always suspect that a tumour of a cystic nature, situated over a fontanelle or suture, and in the median line, particularly when over the nose, may have some communication with the membranes, and should consequently postpone all interference till the diagnosis is clear. As the bones ossify, the opening between the tumour and the cranial contents may close. The cyst, if a small one, may then be excised; if a large one, be injected with iodine. The utmost caution, however, must be employed in the treatment of these cases, and where uncertainty exists as to their true nature or attachments, the prudent Surgeon had better leave the case to nature than risk life by any hazardous enterprise.

Ostitis and periostitis.

Ostitis and periostitis of the bones of the cranium are common affections. They occur as a consequence of a local injury, as a result of syphilis, and other causes. They are also often associated with brain complications.. When considering the subject of traumatic encephalitis this was discussed, together with its treatment, and ostitis coming on from any cause other than injury presents symptoms very similar. I have seen in an infant periostitis, the result of hereditary syphilis, and ostitis ending in necrosis. In another case half the frontal bone exfoliated in a babe after a punctured wound from a nail, without any brain symptoms; and in the adult the complications attending inflammation of the bones, syphilitic or otherwise, are very variable.

Symptoms.

The symptoms are generally local so long as the inflammation is confined to the periosteum covering in the bone—pain and tenderness, with local swelling, being probably the chief; but when the inflammation involves the inner periosteum or dura mater, other symptoms appear; headache being the chief, and this is, as a rule, constant; it is, moreover, frequently associated with an irritable brain; any worry or work increasing pain, causing fever, restlessness, and want of sleep. As the disease progresses delirium, convulsions, paralysis, coma, and death, may be the result.

May terminate in suppuration and necrosis.

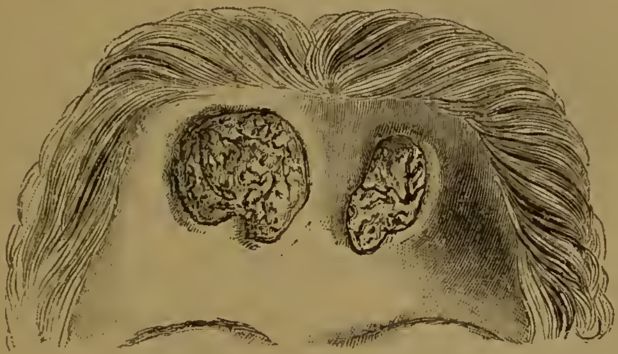
Confined pus may cause compression.

The inflammation in the bone may go on to suppuration, or necrosis, and the dead bone may then exfoliate in masses (Fig. 64) or in small portions. Should no external outlet for the pus exist, it will press inwards and aggravate the brain symptoms; indeed, if no external vent to the suppuration be made, either by natural processes or by the Surgeon, the retained pus within the skull may give rise to symptoms of compression of the brain, to arachnitis, or to abscess of the brain. When the symptoms of compression of the brain from suppuration, the result of bone disease, make their appearance, it is probable that the brain itself and its serous membrane are also involved, and the case becomes a most serious one; it is, consequently, a point of great importance for the Surgeon to anticipate such a complication, and, if possible, to prevent it, and this leads me to speak of the treatment of the affection.

Treatment.

When a patient has had a blow upon the head, or been the subject of syphilis, and as a result a local swelling appears, or local pain of a constant and wearying character, the suspicion of its being due to a local ostitis should be excited. When this swelling is tender to the touch, and pain is aggravated by local pressure, this suspicion should be strengthened; and when these conditions are attended by pyrexia more or less severe, sleeplessness, a quick irritable pulse, and a contracted pupil, the diagnosis may be made of local inflammation of the bone, probably involving the dura mater within and the periosteum without. Under these circumstances a free incision down to the bone is the right treatment, for it is true that by the adoption of this practice, pain and other symptoms are, as a rule, relieved, and, as a consequence, serious brain complications often prevented. When external suppuration is present, with the exposure of dead or dying bone, it is less common to meet with the same cerebral complication, for the pus finds its way externally through the wound, and there is less irritation and pressure on the dura mater, and less brain irritation. Should, however, brain complications be present, it is important for the Surgeon to interfere, and thus try to prevent their spreading, for when confirmed brain symptoms exist, the case is almost hopeless. The Surgeon, under these circumstances, may try to remove the necrosed bone, or perforate it by the trephine—having one common object in both these operations, viz. to give free vent to the pus beneath the bone, which is the source of the brain mischief.

FIG. 64.



Necrosis of frontal bone (from Emily S—, æt. 19). June, 1870.

Free incision.

Removal of dead bone.

Trephining, under these circumstances, is not only a justifiable, but, probably, a valuable, operation, and if performed with care, can do little harm. When interference is postponed till confirmed brain symptoms appear, there is too much reason to believe that irremediable changes have taken place, such as suppuration within the hemisphere or arachnitis, which no operation is likely to relieve. Trephining has, however, been of use in these cases when complicated with epileptiform convulsions; but it would always be well for the Surgeon to anticipate this stage of the disease when he can, and to interfere before such symptoms appear. Headache of a local and persistent character, associated with evident signs of local ostitis or necrosis, are strong arguments in favour of surgical interference.

Trephining.

I need hardly add that constitutional treatment—such as has been mentioned under the heading of encephalitis and will be alluded to when the subject of syphilis is considered—must be carefully followed out.

M. Aran, 'Archives Générales de Médecine,' 1844.—*Cock*, 'Guy's Hosp. Reports,' 1842.—*Hewett*, 'System of Surgery,' by Holmes, Sec. Ed., 1870.—*Le Gros Clark*, 'Lectures at Royal College of Surgeons,' 1869.—*Pott*, 'Injuries of the Head,' 1768.—*Guthrie*, 'Commentaries in Surgery,' 1853.—'Erichsen's Surgery,' 5th Ed., 1869.—Hutchinson's Prize Essay (Astley Cooper), 1865.—*Brodie*, 'Med.-Chir. Trans.,' vol. xiv.—*Wilks and Moxon's* 'Lectures on Pathology.'—*Callender*, 'St. Bartholomew's Hosp. Reports,' vols. i and iii.—*Hilton*, "Clinical Lectures," 'Lancet,' 1853.—*Nélaton*, Attlee's edition, 1855.—*Gama*, 'Traités des Plaies de Tête,' 1835.—*Adams*, 'Cooper's Surg. Dictionary,' 1861.—*J. Neudörfer*, M.D., Prague, 'Handbuch der Kriegschirurgie,' 1867.—*Pirogoff*, N. Leipzig, 1864.—Stromeyer's edition of *W. McCormac's* 'Notes of an Ambulance Surgeon, 1871.

ON TRISMUS AND TETANUS.

Definition

When a patient is the subject of an uncontrollable spasmodic contraction of the muscles of the lower jaw, he is said to have "*trismus*" or lockjaw; and when the same condition attacks other or all the voluntary muscles of the body, he is said to have "*tetanus*." Tetanus includes trismus, and generally begins with it; but trismus may be a local affection. It is found in children as a result of dentition, and in adults as a consequence of diseases involving the teeth, gums, or jaws. It is a spasmodic affection, produced by reflected irritation set up by a local disease. It is rarely associated with any constitutional disturbance, and is, for the most part, cured on the removal of its cause.

Varieties.

Tetanus is likewise generally associated with some local source of irritation, some wound or injury; it is then called "*traumatic*." When no external or visible cause can be made out it is denominated "*idiopathic*." When rapid in its course, it is called "*acute*;" when slow, "*chronic*"—and this division of the subject is the most practical one. The acute form is usually the result of an accident, and is generally fatal. The chronic is for the most part idiopathic, and is more curable.

Infantile tetanus.

Tetanus nascentium.—Tetanus is met with in new-born infants, and is then known as *trismus nascentium*, or *tetanus infantum*. It usually comes on during the second week after birth, and may be so acute in its course as to destroy life in from ten to thirty hours; or so chronic that life may be prolonged to eight or nine days. It is a common affection in the West India isles, and has been known to occur frequently in ill-ventilated lying-in hospitals. Bad ventilation has consequently been put down as one of its causes, the others being cold, exposure, internal irritation, and the division of the umbilical cord.

Predisposing causes.

Predisposing causes of tetanus.—Dismissing the last form of the disease from our consideration, it seems that tetanus may be found at any period of life, but more than half of the cases occur between ten and thirty years of age. The youngest case on record was in a child of twenty-two months, the oldest in an adult of seventy-five years.

It is more common in males than females in the proportion of seven to one. It is found in the healthy as frequently as in the cachectic, and there is no evidence to indicate that the intemperate are more prone to its attack than the temperate. It is as frequent in the winter as in the summer months; but in warm climates the natives are more susceptible to its attacks than are Europeans. Exposure to damp or cold, and sudden changes of temperature, have doubtless a powerful influence in exciting this disease, both in the idiopathic and traumatic forms—Larrey stating that after a great battle one hundred soldiers were found in one morning affected by it.

Exciting causes. *Exciting causes.*—Tetanus may follow every form of injury, the slightest contusion or the severest compound fracture. It may occur after the extraction of a tooth, or after the gravest operation in surgery. As an incident in obstetric practice it is also known as *puerperal* tetanus. It is, however, rare in the course of ordinary surgical disease. It is most common after the more severe varieties of injury and accident, such as burns, compound fractures, and injuries to the fingers and toes. There is no evidence to prove that it is more frequent after slight injuries to the fingers and toes than after injuries to other parts. Seven years' experience at Guy's Hospital gives the following facts (Poland).

Tetanus occurred in	1 case	out of	1394	cases	of major and minor operations.
,, ,,	9 cases	,,	594	,,	of wounds of all varieties.
,, ,,	1 case	,,	856	,,	of injuries and contusions.
,, ,,	3 cases	,,	456	,,	of burns and scalds.
,, ,,	9 ,,	,,	398	,,	of compound fractures.
	23		3698	,,	or 1 in every 160 cases.

Lacerated wounds, however, seem to be more frequently followed by tetanus than incised ones, particularly in children. The state of the wound does not appear to have any influence on the disease.

Date of appearance. There is no definite period at which tetanic symptoms are prone to appear. When they set in soon after the injury, they are for the most part acute and very fatal; when three weeks have elapsed, the chances of their appearance are very small. The later the symptoms set in, the more favorable are the prospects of recovery, although acute cases occasionally occur during the second week; upon this point Poland gives us the following facts:

Of 277 cases, 130 began before the 10th day, and of these 101 died.
,, ,, 126 ,, between the 10th and 22nd day, and of these 65 died.
,, ,, 21 ,, after the 22nd day, and of these 8 died.

In idiopathic tetanus the symptoms generally appear rapidly after the exciting cause, a few hours after exposure to cold being often sufficient. With the same exciting cause, however, like results occur in the traumatic form.

Symptoms. *Symptoms.*—There are no general or local premonitory symptoms of this affection, by which the onset can be recognised. The earliest indications of its approach are generally a difficulty in opening the mouth, with stiffness in the muscles of the lower jaw; but these symptoms may be so slight as to pass unheeded, or be misinterpreted; when, however, some rigidity of the muscles of the neck, throat, or abdomen can be made out, and the first indications of the "tetanic grin," or *risus sardonicus*, recognised—this symptom being caused by the drawing down of the corners of the mouth, by the muscles of the face—the diagnosis becomes certain. Difficulty in swallowing will soon appear, and any attempt to drink fluids will excite spasm of the muscles of deglutition, and often of respiration. Pain, shooting through the body, from the scrobiculus cordis, is often experienced at this time, and is due to spasm of the diaphragm.

Spinal muscles, terms used.

The muscular system generally of the body will now be more or less affected, and in different cases different groups of muscles will be involved. Those of the back are the most frequently attacked, and the contraction of these may be so powerful as to cause an arching backwards of the frame, producing what is known as *opisthotonos.* In rare cases the body is bent laterally or forwards, the terms *pleurosthotonos* and *emprosthotonos* being respectively applied to these conditions.

Respiratory muscles.

The muscles of respiration are, as a rule, affected early in acute cases, and the chief danger to life rests in the severity of the spasms which attack them. When severe, the first spasm may be the last, and this may occur at an earlier period of the affection, or at a remote one. Spasm is the chief immediate cause of death in this disease. In a case under my care, of severe traumatic tetanus, all the symptoms were disappearing, and recovery was confidently looked for; when on the tenth day of the disease, the first spasm of the laryngeal muscles took place, and destroyed life.

When the jaw is unlocked by a spasm of the depressor muscles, the tongue is at times suddenly shot out from between the teeth, and often wounded.

Progress of disease.

As the disease advances the jaws become completely fixed, and deglutition becomes impossible. The spasms of the muscles of the frame become more intense and frequent, and the powers of the patient consequently rapidly decline. The pulse, which has been rapid, becomes more feeble, while the expression of the countenance betokens the agony of the body, and despair of the mind. The slightest manipulation or movement of the patient sets up fresh spasm, and any mental emotion may do the same. The skin becomes bathed with a cold sweat, and if death is not caused by suffocation, exhaustion soon puts an end to suffering.

Absence of fever.

There is rarely any fever during the whole course of the disease. The bowels are always costive, the stools offensive, and the urine as a rule natural.

Intellect perfect.

The intellectual faculties of the patient almost always remain unimpaired throughout, and the senses are morbidly acute. Anything like delirium is rarely seen.

Should the case tend towards a recovery, the spasms will become milder in character, and recur at longer intervals till they disappear; but *it must be remembered that, as long as the slightest evidence of disease exists, a sudden spasm of the glottis may at any time destroy life.*

Diagnosis.

Diagnosis.—This ought not to be a difficult task, and in every instance of lock-jaw the possibility of its being the commencement of tetanus ought to be entertained. Local irritations, such as have been previously alluded to, should be looked for; but all these causes only produce a locking of the jaw more or less complete, they are never accompanied by uncontrollable spasm, as is the case in tetanus.

From strychnine poisoning.

To diagnose between tetanus and poisoning by strychnine may be somewhat difficult, the symptoms of both being very similar, yet in tetanus the symptoms are progressive, while in poisoning they appear suddenly in all their severity. In tetanus the symptoms are always present, and are aggravated at intervals; in poisoning there are complete intervals of relaxation of muscle. In tetanus there is constant rigidity of the muscles of the jaw; in poisoning the jaw is never locked except during the spasm. These points of difference are enough to help the Surgeon in the investigation of a doubtful case.

From hydrophobia.

Again, hydrophobia and tetanus have been mistaken the one for the other, but any one who has seen the former disease could hardly fall into the error. The peculiar restlessness of mind and body in hydrophobia, the complete intervals of rest and absence of spasm, the peculiar aversion that is shown to fluid, accompanied by thirst, are enough to distinguish between the two. Nevertheless, it should be remembered that Dr. Ogle, of St. George's, has recorded a case of tetanus and hydrophobia combined. ('Brit. and Foreign Med. Rev.,' 1868.)

Prognosis.

Prognosis.—In acute traumatic cases there are small hopes of recovery taking place. In chronic cases the chances are more favorable. The longer the patient lives the better are the prospects of a good result; and if ten days pass after the first appearance of the symptoms, and the disease is on the decline, the prognosis is favorable.

Taking all cases together, Poland gives one recovery to seven and a half deaths. More than half the cases die within five days. The most rapid death has been in from four to five hours; and the longest duration of life on record, in a fatal case, is thirty-nine days.

Mode of death.

How death is caused.—There can be little doubt that acute tetanus commonly destroys life by apnœa, spasm of the muscles of respiration, and more particularly of the laryngeal muscles, being the immediate cause. Poland tells us that of forty-six cases in Guy's Hospital in which the mode of death was noticed, in thirty-two it arose from this cause.

In chronic tetanus death is commonly caused by exhaustion. These facts have an important bearing on the treatment of the disease.

Pathology.

Pathology.—The late Mr. Wilkinson King, of Guy's, is stated by Poland to have been in the habit of remarking at the post-mortem table, whenever there was an examination of a case of death from tetanus, "Gentlemen, we will now proceed to give you a demonstration of a case of healthy anatomy, for there will be no visible morbid appearances otherwise than congestion of the organs in various degrees, which are owing to accidental circumstances." And at the present time these remarks hold good. It is true that Rokitansky, Demme, Lockhart Clarke, and Dickinson, have given us some descriptions of structural changes in the spinal cord which they have observed; and these observations moreover appear to coincide. These changes seem to consist of disintegration and softening of a portion of the grey substance of the cord, which appears in certain parts to be almost diffluent. The semi-fluid substance thus formed, however, "is at first more or less granular, holding in suspension the fragments and particles of the disintegrated tissue, but in many places it is perfectly pellucid" (L. Clarke). Yet it is to be remembered, that Billroth and other pathologists have failed to find these changes in the instances they have examined, and it cannot therefore be accepted as certain that these pathological conditions are constant in tetanus. There can be little doubt, however, that the nerves of the injured part are at times found inflamed and irritated, and from this fact the theory has been advanced, that through the injured nerves of the part the spinal centres become involved, and manifest these states of excitement through the motor nerves by producing muscular spasm; the disease being one essentially of the excito-motory system. Clarke believes

Nerves of injured part inflamed.

"that the spasms of tetanus depend on the conjoined operation of two separate causes. First, that they depend on an abnormally excitable state of the gray nerve tissue of the cord, induced by the hyperæmic and morbid state of its blood-vessels, with the exudations and disintegrations resulting therefrom. Secondly, that the spasms depend on the persistent irritation of the peripheral nerves, by which the exalted excitability of the cord is aroused."

Treatment.

TREATMENT.—Every imaginable form of treatment has been employed in this disease with success, to be discarded in its turn for something new. No settled form of practice can consequently be given to guide the student. Still much can be done in this disease in guiding it through its course; in keeping the patient alive; in warding off death.

Diet.

Stimulants.

To keep the patient alive the most careful attention to feeding is called for; milk and concentrated liquid animal food being the best diet. If they can be taken in sufficient quantities, no other mode of administration is required; but if not, they must be given as enemata by the bowel, every four or six hours as the case demands. Stimulants must be used cautiously, but when the powers are failing they may be freely given.

Quinine.

Upon this principle of practice, that some cases have done well under it, quinine has been strongly recommended. It may be given in full doses in an adult, such as five grains every three or four hours, and increased; or one large dose may be given at first, such as twenty grains, to be followed up by the smaller one.

Calabar bean.

Among specific remedies that have been greatly vaunted, the Calabar bean stands foremost. It may be given in full doses, such as half a grain of the extract every two or three hours. Camphor also recommends itself to our notice in doses of from five to ten grains. The woorara poison has failed in its purpose. The bromide of ammonium some have given with apparent advantage.

Curara.

Ice-bags to spine.

It was hoped that a valuable drug for this disease had been found in chloroform, but experience has not justified expectation; and now the hydrate of chloral takes its place and has been of some service. Demme has advocated with much success the use of the Curara, eight cases out of twenty-two having recovered under this treatment; and in India the Indian hemp has been highly recommended. Nicotine and tobacco have also been successful. Aconite is another drug that offers some advantages, and opium has an unquestionable influence in allaying pain and mitigating the severity of the spasm. Ice also, applied in bags along the spine, has apparently been of great value in the hands of American surgeons. The administration of remedies by subcutaneous injection promises to be a valuable adjunct to practice in these cases, enabling us to introduce rapidly into the system drugs that act antagonistically to tetanic spasm.

The patient should always be kept quiet, warm, and free from draught. He should be so tended that in his spasms no injury can be sustained, and attention paid to his bladder and bowels, for catheterism is sometimes called for, and purgatives or enemata to clear out the intestine are of use, although violent purgation cannot be advised.

Question of amputation.

With respect to *local treatment* much may sometimes be done; in severe local injury, when the nerves of the part are probably involved, amputation ought certainly to be performed; for a sufficient number of cases have been recorded in which success has followed the practice.

In 1845 Mr. Key amputated a leg on account of tetanus, which had appeared six days after an unreduced dislocation of the astragalus, and the symptoms disappeared at once after the operation. On dissecting the foot the posterior tibial nerve was found to have been put violently on the stretch by the projecting astragalus. Case.

In some cases soothing applications, such as opium, may be applied to the wound, and in all perfect cleanliness should be enforced.

One other means of cure remains to be noticed, and it has reference to the mode of death in this disease. It has been shown that in the larger proportion of cases—in all the acute—death is caused by suffocation, by spasm of the laryngeal muscles. It is also fairly recognised that this disease will run its course, and that the most our science can do is to maintain life and ward off death. To this end the operation of tracheotomy seems to be of value, for with a tube in the trachea, death by laryngeal spasm cannot take place, and a better prospect of recovery is consequently given. Tracheotome.

I have employed this practice in one acute case, in which the Calabar bean was likewise given, and the patient sank from exhaustion, free from spasm; and there seems good reason to believe that if I had performed the operation in the case I recorded in the early part of this chapter, life would have been saved. This question, however, requires grave consideration, and the practice is not to be rashly adopted.

Morgan, 'On Tetanus,' 1833.—*Curling*, 'On Tetanus.'—*Poland*, 'Guy's Hospital Reports,' 1857.—*Dr. Ogle*, 'Brit. and For. Med. Review,' 1868.—*Dr. Dickson*, 'Med.-Chir. Trans.,' vol. vii.—*Dr. L. Clarke*, Ibid., vol. xlviii.—*Dr. Dickinson*, Ibid., vol. li.—*Demme*, 'Schmidt's Jahrb.,' vol. 112.—*Thamhayn, O.*, Ibid.—'Year-Book,' Sydenham Society, 1862-64, &c.—"Puerperal Tetanus," 'Dublin Quart. Journ.,' 1865; 'Med. Times and Gaz.,' 1865.—*Billroth*, 'Pathol. Chirurg.,' 1868.

DELIRIUM TREMENS.

It often falls to the lot of the Surgeon to treat cases of pure delirium tremens, uncomplicated with any surgical malady, and it is well, therefore, to refer to this subject by itself. There are other cases, perhaps, more aptly described by the term "*traumatic delirium*," in which the nervous symptoms are developed as a consequence of an injury received. In both classes of cases the symptoms are essentially the same, and the treatment required is similar, but it is right to bear in mind the difference in causation, as in the one case we have to deal with a nervous disease in an intemperate person, and in the other with the same symptoms as an incident in a surgical case. In simple delirium tremens, to use the familiar term, we have to deal with the case of a person who has indulged for an uncertain time in injurious doses of alcoholic liquors. It may be that a young man, after a prolonged debauch, gets an attack of the "horrors," but the symptoms more often occur among those who have for a long period accustomed themselves to the excessive use of beer or spirits, even without amounting to drunkenness, and who get upset by some shock or depressing influence. Inasmuch as the habits which have been mentioned as inducing this disease are opposed to the simplest laws of health, it follows that they cannot be indulged in for long with impunity, and we, consequently, find the subjects of it, as a rule, of feeble powers of resistance, and often with diseased viscera. Such persons are bad subjects for any ailment, and it often happens that when a person of this sort breaks his leg, or meets with some injury Traumatic delirium.

requiring surgical treatment, that he developes an attack of delirium tremens. Other causes are occasionally at work, such as starvation, mental anxiety, and the over-use of tobacco or opium.

Premonitory symptoms.

The disease is at times ushered in by certain premonitory symptoms; for patients who have once been the subject of an attack are sometimes conscious of the approach of another. A brewer who had been treated for this affection at Guy's some years ago, on several occasions subsequently applied for admission, when he felt warnings of its advance, and as a result the attack was warded off.

Depression of mind and of body are the chief premonitory symptoms, with restlessness and agitation, gloom and foreboding of evil. Some slight febrile disturbance may exist, but the one constant and most important symptom is sleeplessness. The tongue is generally pale and flabby, and coated with a whitish fur: it is never dry. The appetite is bad, the breath is often fœtid, and the bowels are confined. The pulse may be quick, but it is soft and powerless. The skin is always moist, and at times bathed in perspiration. With these symptoms the characteristic delirium with trembling is not far off. It may, however, in surgical practice set in suddenly without warning. The nature of the delirium is very characteristic; it is always accompanied by illusions, and these are generally spectral. The patient sees things that do not exist, and hears sounds that have no reality; these are always of a strange or frightful nature. At times some delusion about business or home matters agitates the mind. The same ideas are sometimes fixed during the whole attack; but more commonly various ideas succeed one another in rapid rotation. Sleeplessness under these circumstances is a constant result. The patient will for a time be quiet, muttering words without meaning, or he will be restless and get out of bed in obedience to some imaginary call. He will pull his bedclothes about. He will be up in bed at one moment under one impression, and will lie down again under another. If asked to put out his tongue, he will do so, but probably with a jerk; if to give his hand, he will project it with a thrust. A nervous trembling of the extremities with an utter want of control or steadiness of purpose is characteristic. If these symptoms continue, and rest cannot be obtained, prostration of all the powers will rapidly appear, and death either by exhaustion or coma. If sleep—sound sleep—can be secured, the symptoms usually rapidly mitigate.

Its characteristics.

Delirium and tremor.

Want of sleep.

Prostration.

Prognosis.

The *prognosis* in such cases must depend on several considerations. If the patient be young and the attack ensue after a short period of drinking, the chances of recovery are good, but if the attack occur in a man of middle age, habituated to over-drinking, and if his liver or kidneys be unsound, it is fraught with much greater danger. Moreover, if the attack be associated with an injury, such as a wound or fracture, there is another element of danger introduced. The best guide to the patient's real condition is the study of the pulse, not merely as to the number of its beats, but its character. The sphygmograph is of great service in such cases; by its help a "dicrotic" state of pulse is often shown, where the finger would not indicate it, and this condition is a sign of bad omen. The most frequent complication is pneumonia, which often comes on rapidly and insidiously, and is a common cause of speedy death even when the excitement has subsided.

Treatment. TREATMENT.—This disease being essentially one of depression of the nervous system, associated with sleeplessness, the main object of the surgeon is to procure sleep, to calm the excited brain, and give it time to recover its normal functions; and to this end absolute quiet and the use of bland and nutritious food are most essential.

Food. Easily digested, nutritious food must be administered when it can be taken by the mouth, and when refused or rejected, resort must be had to enemata. Milk is, undoubtedly, the most suitable form of nourishment, either alone or mixed with eggs or stimulants, but it will not suit all stomachs. The question of giving stimulants, and to what extent, is one of great importance. As a rule, the less given, perhaps, the better, but in most cases it is advisable to give something, and generally that form of alcohol to which the patient has been accustomed. Young men with an acute attack may do well without stimulants, but in other cases the feeble powers of the patient require some such aid to stand against the exhaustion caused by the restlessness and excitement. The chief reliance, however, should be placed on other forms of food, such as strong animal broths, Darby's fluid meat, or some such preparations.

Opiates. Opium, in some of its preparations, is a drug still in favour; although some reject its use altogether, and trust to feeding and time; relying upon the knowledge that the disease has a natural tendency to terminate in sleep after the second or third day. In an ordinary case of the disease, one grain may be given as a dose, or ♏xx of the tincture, and repeated every three or four hours or oftener, till sleep is procured. In other cases two or three grains may be given at once, and followed up by grain or half-grain doses.

The best method of administering drugs in this disease, however, is by subcutaneous injection, and I should recommend the injection of morphia in solution in doses of a quarter or half a grain, in preference to any other plan; for the condition of the stomach of patients suffering from the disease is far from satisfactory either for absorption or assimilation, and by the hypodermic method of introducing the narcotic into the system, its absorption is more certain and more rapid. In some cases the beneficial influence of morphia thus employed is most remarkable, and it is only in exceptional instances that the treatment fails.

The use of chloroform has also been urged, but such a plan is not devoid of danger and can hardly be advised except for some temporary purpose, such as dressing a wound, or to enable an enema to be given. The hydrate of chloral is a drug of great value, as possessing hypnotic qualities without the evils attendant on other drugs of this class. It may be given in doses of 20 to 40 grains, and repeated, at moderate intervals, till sleep is procured. Drs. Kinnear and Lawson in the Melville Hospital have treated from 70 to 80 cases successfully with large doses of cayenne pepper, from 20 to 80 grains having been given for a dose. Dr. Maclean, of Netley, trusts to quiet and the use, at short intervals, of strong beef tea highly charged with cayenne pepper.

Digitalis. Of late years the value of digitalis has been greatly extolled, but my experience of this drug has not been favorable. It is given in large if not poisonous doses; two drachms of the tincture every hour for three or four doses, till sleep is produced. It is a dangerous plan of treatment, and cannot be recommended.

When great excitement and some fever exist, antimony in small doses has been much advocated. The condition of the bowels almost always demands attention, for the tongue is usually foul and the secretions are morbid. A purge sufficient to empty the colon is consequently of service, but violent purgation is injurious.

Tonics.

Tonics, as quinine and iron, with or without opium, will be required as the disease subsides. The combination of the tincture of iron with the tincture of opium in carefully regulated doses is to be preferred; in other cases ammonia with bark may be administered.

Question of restraint.

With respect to coercive measures in the treatment of these cases, there is no doubt that they are to be condemned. In exceptional instances, where sufficient help cannot be obtained to prevent the patient from injuring himself or others, the jacket doubtless must be employed, but under no other circumstances is it justifiable. An attendant who combines decision of character and firmness, with a gentle and soothing manner, will almost always succeed in "influencing" the most troublesome patient. He is to *influence* him, however, and not to direct him; for contradiction and the exercise of authority over such subjects of disease always excite opposition.

Chronic intemperance.

There are some people who never get drunk, yet are always drinking; in whom the tissues are so weak that under injury they rapidly break up; and under disease they show no power of repair. In such cases it is difficult to get wounds to heal or any process of repair to show any vigorous action.

The best plan is to ply such patients with all sorts of nutritious food, to give tonics and a moderate amount of stimulants, and thus endeavour to improve their habits and restore them to a more healthy tone. These cases illustrate the influence of chronic habits of intemperance on the constitution.

SHOCK AND COLLAPSE.

Shock.

A man receives unexpectedly some startling news, exciting severe mental emotion, and dies suddenly, he is said to have died from shock; a second receives a blow upon the epigastrium with the same result; a third is struck dead by lightning, and death is assigned to the same cause. In all the heart's action is suddenly arrested through the nerve centres—in one case through the emotions, in the others through the body. Under these circumstances the heart is found full of blood, with all its cavities distended, this distension paralysing the action of the organ.

Collapse.

A man receives a severe compound fracture, gunshot or other injury, a violent general shaking of the body; he is not killed, but collapsed. He has sustained a shock more or less intense, and, as a consequence, is cold and almost, if not quite, pulseless. His skin appears to be bloodless, and is covered with a cold clammy sweat. He may breathe almost imperceptibly, feebly, or with sighs and gasps. His nostrils will, probably, be dilated; the eyes dull and vision imperfect; consciousness may be present in very variable degrees, for the patient may possibly be roused, but, as a rule, he requires rousing to prove its existence. At other times the intellect remains quite clear.

Its signs.

These are briefly the signs of collapse, or shock, the result of injury. They are to be found in variable degrees after most accidents, and are by no means usually fatal, unless the injury itself is fatal. Of course if the shock from the injury is very great the heart may cease to beat and the lungs to breathe, collapse passing, more or less slowly, into death; but more usually after a variable period, the heart's action gradually improves, the respiratory act becomes more regular, and perfect colour returns to the bloodless lips and skin, warmth reappears on the surface of the body, and consciousness becomes more manifest, these symptoms indicating what is known as reaction, and when they pass into excess febrile symptoms may appear. It should be noted that vomiting is often the first indication of reaction in general collapse, as it is often in that of head injuries. Should the nature of the accident be such that hæmorrhage complicates the case the collapse will be more lasting, the shock of the accident passing into the collapse from hæmorrhage, and under such circumstances a fatal result is very likely to appear, the amount of bleeding and its rapidity determining the result, for it should be known that hæmorrhage by itself is enough to produce collapse, or syncope, and this added to the shock of the injury is more than enough to destroy life. In abdominal injuries this connection of events is well seen, the hæmorrhage from a lacerated liver or other organ, as a rule, appearing with the first manifestations of reaction from the shock of the accident, and thus proving fatal.

Reaction.

The longer reaction is delayed the more grave is the aspect of the case, and not unfrequently relapses appear, signs of reaction and of collapse alternating in variable degree till one or the other is established in a recovery or the reverse.

Delayed reaction.

In rare cases, even from the shock of a slight accident, reaction is followed by exceptional symptoms; thus, I had a man under care who was admitted with a slight concussion of the brain in whom reaction was attended with an acute attack of maniacal excitement, which left him after two days to pass on to a steady convalescence; a woman with a similar injury, attended with a scalp wound, had a like attack, which lasted two weeks and then subsided without any bad results. I have recorded also, in another page, a case of general tetanic spasm which showed itself in the reaction after a case of spinal injury. More commonly reaction is attended with what Travers has described as "prostration with excitement," a state bordering on, and often passing into, that known as delirium tremens.

Mania on reaction.

Tetanus.

Under some conditions of the system shock and collapse are more readily produced than they are at others; very young and very old subjects are particularly apt to die of shock after injury or operation. When general feebleness, from age or otherwise, mental or physical, exists, this is well seen, subjects so situated being unable to withstand the effect of any shock. Patients with bad kidneys, again, are very prone to suffer from shock, and to succumb to any operation, however trivial. Surgeons see this at times in the sinking after small operations. Thus, I lost some years ago, after the removal of a fatty tumour, a woman of middle age simply from asthenia; the operation having been unattended by any loss of blood; and a child, æt. 8, after some operation on a cicatrix of the neck, in the same way. In both, bad kidneys were found after death. The idiosyncrasy of the individual has also a powerful influence on "shock."

Conditions favorable to shock and collapse.

Albuminuria and shock after operation.

Treatment.—Shock or collapse uncomplicated with hæmorrhage

Treatment.

may be treated in one way; shock or collapse the consequence of or combined with hæmorrhage in another.

In both cases the heart's action must be either excited or maintained; "the heart must beat, and the patient must breathe," or life will fail. Even in the worst cases, as long as any signs of life exist, the respiratory process may be aided by artificial respiration, and the warmth of the body kept up by external applications; and even if no evidence of the heart's action be detected, and no hæmorrhage complicates the case, Savory, in an able article ('Holmes's System,' Ed. 2, vol. i), advises, as the result of experiment and reason, that a vein should be opened—as the external jugular—in order that the overdistended heart may resume its action as soon as it is relieved from its paralysis by distension.

Venesection.

Transfusion.

In the extreme collapse following hæmorrhage transfusion is also "a fair and rational expedient."

In less severe examples the Surgeon's object is to keep the patient alive, but he ought not to wish to do more; to force nature is always injurious, and sometimes may be fatal. The failing powers of a feeble subject may be excited to act only to give way again, when they may not respond to the former stimulant.

A too rapid reaction may so stimulate the heart as to set up a fatal hæmorrhage, when by the collapse the wounded artery might have become sealed by nature's own blood-clot.

In all cases of shock and collapse, therefore, complicated with loca injury, great judgment is called for. To do enough to maintain life is essential, to do more is injurious.

Posture.

External warmth.

The horizontal position under all circumstances is to be observed, and external warmth by warm blankets, &c., applied, with hot flannels to the pit of the stomach. Sir J. Simpson's plan of applying heat to the body is very good; he did it by filling six or eight soda-water bottles with boiling water and tightly corking them, and then drawing over each a woollen stocking wrung out of hot water. The bottles so covered were then packed around the patient in bed. Stimulants in carefully adjusted quantities may be given, brandy being the best. This is to be given in small quantities, and should the heart's action fail to respond to its administration after two ounces or so have been swallowed, more is of little use, the stomach usually rejecting it. When the stomach rejects brandy, or the patient cannot swallow, an enema of brandy in warm starch, milk, or gruel, sometimes acts very rapidly. As soon as the heart's action is established, liquid food, such as warm milk, may be given, but only in small quantities, and the case must be watched, such food and stimulants being given with discretion as the symptoms indicate, the greater the loss of blood the greater being the necessity for food.

Stimulants.

Food.

Remedies for excessive reaction.

Excess of reaction is to be checked by soothing remedies, opium in any of its forms, henbane, and chloral, are very valuable drugs, a few hours' calm sleep generally acting like a charm, but when brain complication appears this treatment is to be adopted with care. Anything like coma contra-indicates it.

Amputation in collapse.

In compound fractures and other local injuries demanding operation it is an important question to decide as to the wisdom of operating on a patient in a state of shock. Will the operation act as a stimulant, and tend to rouse him? or will it act as a second shock, and tend the other way? When the shock is severe, and the patient almost pulseless, it is doubtless the wisest plan to postpone all operative interference till the heart's action is re-established. To amputate a limb under extreme collapse is to destroy all chance of life, or to do an unnecessary operation. To amputate when reaction has set in after the lapse of a few hours, when external warmth, stimulants, and tonics have had their influence, is far more likely to prove successful.

When permissible.

In less severe examples of collapse, however, the same practice does not seem to be necessary, more particularly when hæmorrhage has been the partial cause, and is still continuing, for when collapse is present the loss of very little extra blood by oozing forbids any hope of a good reaction being established, and thus no good can be acquired by delay, but only harm. The administration of chloroform has, moreover, a stimulating influence upon the heart and nervous system, which is often very valuable. I have often performed primary amputation upon subjects in a state of partial collapse after injury under these circumstances, and have never regretted it. With a patient in a state of collapse no amputation should, however, be performed when by delay no harm can accrue. When hæmorrhage, however trivial, is going on, or is likely to recur at any moment, the Surgeon should interfere and remove the part when its removal is essential.

When the collapse is associated with semi-consciousness chloroform is not needed, the operation itself acting as a sufficient stimulant; but when the mind is clear to what is going on, its use should not be withheld, for although it is true its secondary effects are sometimes depressing, and may be injurious, in a general way it has a beneficial influence, and tends to prevent a second shock, both mentally and physically.

When extreme collapse exists.

When collapse is extreme.

"How far," writes Savory, "the patient should be allowed to rally, and when he has reached that state which will enable him to bear the operation, are, of course, questions which cannot be answered in a general manner, but which must be decided by the Surgeon in each case."

Where the Surgeon is in doubt about acting he had better decide in favour of delay. When no doubt exists as to the wisdom of removing an injured part, and by delay harm must or may probably ensue, he had better act at once, even when the patient has not quite rallied from the shock of the injury. When, so far as the local injury is concerned, the delay of a few days or hours is unimportant, all operative interference should be postponed.

In severe compound fractures, gunshot or otherwise, hæmorrhage is almost sure to occur as soon as reaction appears, and the shock of the removal of a limb is not so much to be dreaded as the loss of blood. "Wounds of the large arteries of the legs and arms from balls and shells always bleed more or less at the time of reception, and more freely as the shock to the nervous system passes off and reaction comes on. Even when this nervous shock is not sufficient to produce immediate death, the chances for ultimate recovery must frequently turn on the mere question of loss of blood." (Hammond, U.S.)

In military practice primary amputation upon the field is now generally preferred to secondary, and in civil practice a like rule should be enforced under analogous circumstances.

To perform any capital operation upon a patient in a condition of extreme collapse or shock is bad practice. To do so, however, when a minor degree exists, and the pulse is to be felt, when by delay other dangers are to be expected, such as continued or renewed hæmorrhage, is sound and good surgery. To an unconscious or only slightly conscious patient, chloroform is not needed. To a conscious one it has often a beneficial action, and tends towards the encouragement of reaction.

FEIGNED AND HYSTERICAL OR MIMICKED DISEASE.

Feigned disease and hysteria contrasted.

I have placed these two classes of cases together for purposes of convenience, and for no other; and I have done so in this section of my book, as they are essentially diseases of the nervous system. Both in a measure, and with different degrees of accuracy, simulate real or organic disease, but feigned disease is a deception, hysterical disease a reality. In the *former* case the will of the patient is strong to deceive, it is bent to simulate the symptoms of an affection of which the individual knows something, but not all, and from this the full knowledge of the Surgeon or Physician is to override the imperfect knowledge of the impostor and expose him. In the *latter* case the will of the patient is weak; functional derangement is allowed to assume the garb of organic disease; subjective symptoms are intensified, not, however, from motives of deception, but from a want of the controlling influence of health, more particularly of the nervous centres, a condition of hyperæsthesia commonly existing from some imperfect nutrition of the nervous centres. In exceptional cases anæsthesia is present, more particularly in the larynx.

Feigned disease is a voluntary deception from the beginning to the end—it is unreal. Hysterical disease is an involuntary exaggeration of some functional derangement, "an unwilling imitation of organic disease"—it is real.

General remarks on feigned disease.

Feigned affections are mostly met with in the intellectually weak, or those of crafty character, and in a general point of view are attended with an exaggeration of symptoms far beyond those met with in real or organic disease; pain is said to be far more intense than is usually met with, paralysis more complete; every symptom simulated is extreme; inconsistencies are present which are not reconcilable with those symptoms usually met with in the disease simulated, and these inconsistencies and exaggerations should always excite suspicion in the mind of the practitioner, and make him test quietly every symptom or group of symptoms, and doubt his diagnosis until he has proved its truth. To the *subjective* symptoms, or those complained of by the patient, these remarks are most applicable; but to the *objective*, or those palpable to the observer, they are so to a degree. The subjective symptoms are always exaggerated, the objective are inconsistent; the former are too bad for truth, the latter are inconsistent with experience.

For example, the rigor of an ague may be simulated, but the hot and the sweating stage cannot well be. Epileptic convulsions, catalepsy, or madness, may undoubtedly be imitated; but in all these there will be when present some exaggeration or inconsistency not found in the real disease. Paralysis can also be readily simulated, but it will, probably, be too complete; it will, on testing, more particularly when done unexpectedly, be associated with a greater degree of sensibility in the skin than is usually present; when of long standing it will not be attended with the usual wasting. Vomiting, coughing, or spitting of blood, can be artificially produced, but under these circumstances the severity of the symptom will, probably, contrast strangely with the mildness of any others with which it may be attended.

In fact, in feigned diseases, on a careful investigation into the history of the case, the succession of symptoms, their progress, intensity, and duration, some point will be brought out which is irreconcilable with truth, some suspicion that deception is at work will be excited, which, if worked out, will unmask the impostor and prevent error.

On hysteria.

The subjects of *hysterical disease or of nervous mimicry* are mostly what is called nervous and emotional—they have commonly "a very unusual mental character; in the majority, there is something, notably, good or bad, higher or lower, than the average—something outstanding or sunken."—PAGET. In this affection "every part of the body may become, under provocation, the seat of an apparent disease that in reality does not exist; it may, and often does, assume all the attributes of reality with an exactness of imitation which nothing short of careful and accurate diagnosis can distinguish from the real disease."—SKEY. In joint and spinal disease the truth of this is most frequently seen, Brodie having stated "that among the higher classes of society at least four fifths of the female patients who are commonly supposed to labour under diseases of the joints labour under hysteria.

Diagnosis.

How, then, it may well be asked, is the hysterical affection to be made out from the real? How is the Surgeon to avoid falling into the error of treating some functional derangement as organic disease?

In a general sense, it may, probably, with truth be laid down that in hysterical affection of a part local pain and sensitiveness, on manipulation, are always great, and they bear no relation to the amount of changes visible or to be detected in the part; the slightest touch excites pain, when probably a bold one fails to do so; the pain rarely, if ever, follows the anatomical course of any nerve or nerves, and the onset of the symptoms is generally more sudden and severe than that usually ushering in organic affections; febrile disturbance or increase of temperature rarely complicates the case, however severe the local symptoms may be, and the nervous "disturbance very rarely takes the form in which morbid nervous influence produces, not mimic, but real organic changes."—PAGET. In fact, all the subjective symptoms are far more severe than the objective, these latter being either very slightly marked or non-existing. For example, a girl is suddenly seized with severe and lasting pain in the hip, knee, or other joint, aggravated by movement or the slightest touch, and yet no visible alteration in its outline or structure can be detected, even after the lapse of many months. Another is as suddenly affected with spinal affection, as indicated by local pain in the back, inability to stand, &c. &c., without any local evidence of organic disease. A third suddenly finds herself unable to flex or extend a limb, and the slightest force excites severe muscular spasm and pain. A fourth is attacked, without a cause, with some muscular spasm, possibly involving a finger or fingers—a spasm that resists all attempts at extension. A fifth suddenly loses sensation or the power of motion in some part of a limb, quite irrespective of nerve supply. In these cases, again, however severe the pain may be during the day, it is rarely so at night. Such patients, as a rule, sleep well and quietly. During sleep, also, it often happens that joints which are immovable by day are found to be more flexed or extended. Patients with supposed diseased spine are found on their sides coiled up in a natural attitude. As an aid to diagnosis, the value of some anæsthetic cannot be too highly praised, for with a patient under its influence rigid parts rapidly yield, rigidity of muscle returning only with consciousness, and parts supposed to be paralysed often move, suspected joint disease disappearing by a close examination where before doubt existed.

Value of anæsthetics.

Hysterical disease is more commonly met with in female than in male subjects, in the single than in the married, in those whose nervous systems have been unstrung from some mental or physical trial, or in those whose emotional centres are inadequately balanced by the higher controlling ganglia. It is characterised by the suddenness of its attack and the severity of all its subjective symptoms, neither the clinical history of the case nor the objective symptoms present being consistent with those usually met with in organic disease; the exaggeration of certain symptoms and the absence of others, and the anomalies of its nature, mark the hysterical affection over the organic, and are enough to excite a doubt in the Surgeon's mind as to the true nature of the affection.

For valuable information on this subject the reader may be referred to the lectures of Brodie, Skey, and Paget, Russell Reynolds' essay on hysteria, and Anstie's lectures in 'Lancet.'

CHAPTER VII.

INJURIES AND DISEASES OF THE SPINE, &c.

Spina bifida.

Description.

A spina bifida is essentially a hernia of the membranes of the cord through an opening in the spine, due to a congenital deficiency from arrest of development in some portion of the bones forming the spinal column. It is analogous to the meningoceles of the cranium already described. It always contains subarachnoid fluid, and often the spinal cord itself or large nerve trunks. Mr. Hewett believes that when the fluid has collected in the subarachnoid space, or between the cord and the membranes, the cord is pressed; and that when fluid alone is present, the collection is situated in the cavity of the arachnoid. Mr. Hutchinson has recorded ('Path. Trans.,' vol. viii) a case in which the serous sac in the cauda equina had a direct tubular communication with the cerebral ventricles; and in the specimen figured on p. 255 (Fig. 65), taken from a dissection kindly made for me by Dr. Pye Smith, there was a funnel-shaped opening leading from the centre of the cavity into the cord, clearly the persistent central canal of the cord, the nerves being spread out under the internal lining of the sac, and thus forming one of the layers of its wall.

Characters of the tumour.

The spinal hernia is at times covered by the whole thickness of integument; at others, by external integument that is thin; while in a third class the walls are represented by a transparent membrane. This last condition was present in ten cases out of twenty-seven that have fallen under my care. The tumour may have a broad base and free communication with the spinal canal, or a narrow and more or less pedunculated one. Under the former circumstances, the probabilities of the cord being directly involved are greater than under the latter. The tumour is always more or less globular, tense, and elastic. When the child is asleep or quiet the swelling may be soft; but when the child cries the tumour will rapidly fill out. The edges of the bony orifice are occasionally to be felt.

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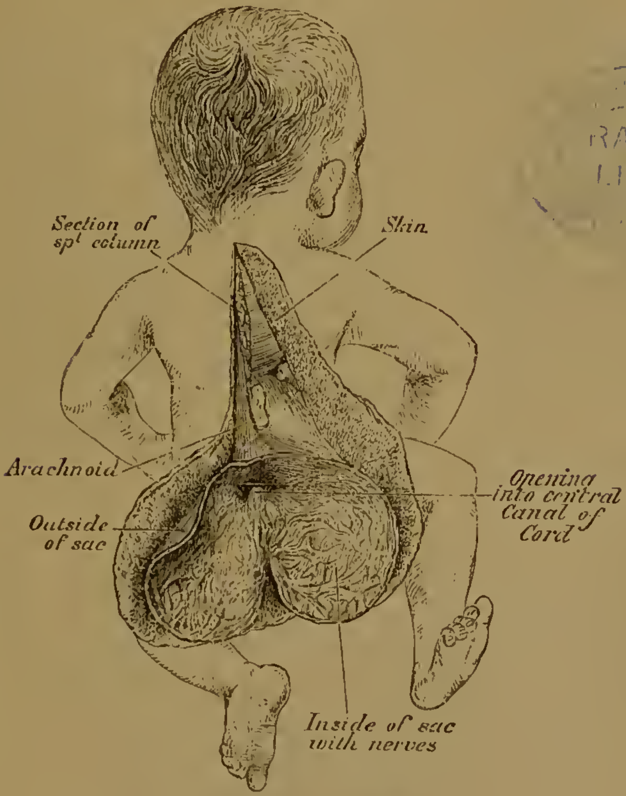
FIG. 65.



Dissection of spina bifida.

May ulcerate.

The integument is in some instances ulcerated even at birth; in others there will be a small opening in the walls, through which the serous spinal fluid exudes. A nævus is by no means rarely found situated over the tumour.

Associated with hydrocephalus.

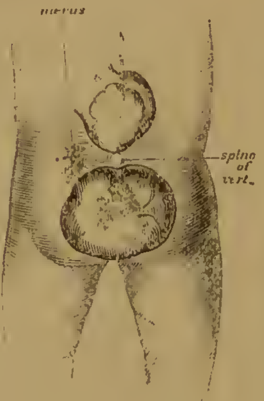
The tumour is often associated with hydrocephalus, and in exceptional examples is double. (Fig. 66.) Other complications, such as club-foot or paralysis of the lower limbs, are frequently present with it. Under such circumstances, it is tolerably certain that the cord is included in the hernia, the nature of the deformity being determined by the special nerve complication. Incontinence of urine or of fæces may coexist with the paralysis, or be independent of it. Paralytic symptoms are more common in the broad-based hernia than in the narrow.

Paralysis.

Site of lesion.

The lumbo-sacral portion of the column is more frequently affected than any other; but the cervical, dorsal, and sacral portions are also liable to the defect. Thus, in twenty-seven examples which consecutively came under my care, thirteen occurred in the lumbar region, four in the lumbo-sacral, and nine in the sacral. One was double, a small tumour being in the lumbar and a large one in the sacral region. (Fig. 66.) Twelve of these cases were uncomplicated with any paralysis or deformity. In eleven there was incontinence of urine and fæces, and in four of these paralysis of the lower extremities. Four were complicated with hydrocephalus, two with nævus, and one with talipes. I have seen but one example in which the tumour was in the cervical region. When the tumour is complicated with hydrocephalus, fluctuation may often be felt between the two parts, pressure on the head causing a fulness of the spinal hernia, and *vice versâ*. In exceptional cases the spinal hernia may protrude on the anterior part of the spine.

Fig. 66.



Double spina bifida, from Eliza F—, æt. 3 months).

Diagnosis.

Diagnosis.—In a general way there is no difficulty in diagnosing a spina bifida. In any infant a congenital tumour over the spine is probably a spina bifida; if globular and tense, or capable of becoming tense when the child cries, the probabilities are almost converted into a certainty, inasmuch as the only cases for which this affection is liable to be mistaken are congenital tumours unconnected with the spine—cystic, fibrous, fatty, or fœtal tumours. These may be hard and tense, but they are rarely, if ever, made so much more tense by the child crying as is the spinal hernia.

Prognosis.

Prognosis.—Almost all these cases prove fatal. Many of the subjects are ill-developed, and they die within a few days of birth; some die in convulsions, and this mode of death is very usual when the sac bursts and its fluid contents escape. The rupture of the sac is not, however, necessarily followed by this result; it is to be expected only when the fluid rapidly escapes. I have watched a child with this affection for four years, in which at birth the tumour was transparent and soon burst, and although it has discharged at intervals for three years, it has now gradually contracted up into a solid mass. This case promises to be an example of a natural cure, which does at times take place by the gradual approximation of the bony walls and closure of the orifice of the hernial sac. The more pedunculated the tumour the better the prognosis, as long as no complication exists that threatens life.

Treatment. Palliative.

TREATMENT.—Palliative treatment is all that can be followed in the large majority of cases, although in exceptional instances operative interference promises to be of use. The tumour must always be guarded from injury by some soft protective material, such as cotton wool or spongio-piline. Slight pressure just sufficient to prevent rapid increase of the tumour is also good, and the best method of applying it is by a casing of gutta percha or felt moulded to the part. The application of collodion is sometimes useful.

Tapping.

Successful cases are recorded in which tapping of the hernia has been performed; but the practice is a dangerous one, for the drawing off of the fluid has been followed by convulsions and death. Nevertheless, it is the least formidable form of practice that can be undertaken, and should always be employed before more active treatment is resorted to, if only as a preliminary measure. The puncture should always be made at the side of the tumour, for the cord when present is probably placed in the median line. The whole of the fluid should never be drawn off.

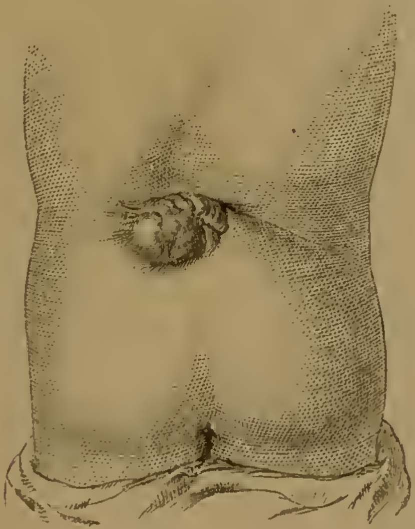
Case cured by tapping.

In Fig. 67 is represented a case cured by puncture. It occurred in the person of a man, æt. 26, who came under my care at Guy's Hospital in 1874, for some ulceration of his left foot, which with the left lower extremity was wasted from infantile paralysis; he had also a lateral curvature of the spine towards the right side, and a cured spina bifida in the lumbar region. I found out from the man that he had been treated for the spina bifida by Mr. W. E. Image, of Bury St. Edmund's, who kindly sent me, in answer to a note, the following account of the case.

Case of cured spina bifida.

"The child was brought to me when about two years old, because the tumour was increasing in size and convulsions were produced whenever any pressure was applied to the tumour, even from the weight of the body when placed in the supine position. The tumour was large and semi-transparent. I punctured it obliquely with a darning needle at intervals of two or three days, four or six times, and applied a compress of lint by means of strapping over the tumour. After this the fluid was not again secreted, the convulsions ceased, and the case got well." At the present time a hard puckered tumour alone

FIG. 67.



Cured spina bifida, taken from man æt. 26.

exists to indicate the affection. A model of the case will soon be found in the Guy's museum.

Injections.

When unadvisable.

Mr. Holmes speaks somewhat favorably of the practice by injection, and believes it to be often harmless. When performed, the fluid should only be partially withdrawn, and four or five drops of the tincture of iodine diluted with a drachm of water injected. The strength of the injection may be increased on each occasion, the object being to excite a slow process of inflammation in the cyst. In no case where the base or neck of the tumour is large should this or any other operation be performed, for it will be injurious; nor in those cases in which it is evident the cord is implicated or large nerve trunks are involved. In pedunculated tumours it may be attempted.

Dr. Ross Watt, of Ayr, N.B., has recorded ('Brit. Med. Journ.,' April, 1873, Jan., 1874) two successful cases in which he injected at intervals of seven or ten days half a drachm of Dr. Morton's solution made by dissolving ten grains of iodine and thirty grains of iodide of potassium in an ounce of glycerine. The injection was thrown into the sac after the withdrawal of the spinal fluid. Dr. Morton by the same treatment had had two good results.

Excision.

With respect to the *excision* of the tumour, a successful case has been recorded in the 'Path. Soc. Trans.,' vol. xiv, in which Dr. Wilson, of Clay Cross, removed the tumour five days after the closure of its neck by means of a clamp; and when excision is entertained this plan is probably the soundest. It should, however, only be thought of when the neck of the tumour is narrow and there is no evidence of the spinal marrow or nerves being involved in the disease. In pedunculated tumours in which the neck is narrow, and there is no paralysis of the lower limbs or incontinence of fæces or urine, the plan of treatment adopted by Dr. Wilson may be employed, but in all broad-based tumours associated with paralysis operative measures had better be left alone.

Exceptional cases are on record of recovery after every form of practice, but upon the whole the result is not very encouraging.

Sacral and Coccygeal Tumours.

Characters.

Their nature.

Examples.

Congenital tumours are by no means infrequent in the neighbourhood of the coccyx or sacrum. They are sometimes composed of cysts, sometimes of fat or fibre tissue, and occasionally of fœtal remains. They are generally central. Many of these tumours have, doubtless, been described as false spina bifida, and in rare examples there is reason to believe they are cured cases of spina bifida, the sac of the hernia having been occluded at its neck by the natural contraction of the parts around. I have seen one case of this in an adult where the tumour was successfully excised. Mr. Pollock has recorded, in the eighth volume of the 'Path. Trans.,' an example of congenital fatty tumour which he successfully removed from the central lumbar region of a child æt. seven; and Mr. Athol Johnson, in the same volume, a rare case of fatty tumour clearly developed in the spinal canal itself. I have had occasion to remove, from a child æt. ten, a large congenital sebaceous cyst placed between the anus and coccyx, and from another child a tumour containing fœtal remains, situated between the sacrum and the bowel. I may also refer to a third interesting case of cystic tumour of the sacrum, possibly spina bifida, which burst, and went on to recovery. The following are the brief notes of the two latter cases.

Notes of cases successfully treated.

Marie B—, æt. seven weeks, was brought to me in 1868, with a congenital tumour the size of a large orange projecting from between the bowel and coccyx; it apparently passed up in front of the bone. (Fig. 68.) It had been growing rapidly since birth, and was pressing upon the bowel; the child in all other respects was healthy. I excised the growth, and found that microscopically it was made up of fat, fibro-cellular tissue, mucous membrane, cartilage, and bone elements. Good recovery ensued and the child has kept well.

A male child, two days old, was brought to me on July 30th, 1868, with a large cystic tumour covering in the lower half of the sacrum and occupying the perinæum (Fig. 68A); it was the size of a cocoa nut, and transparent as a spina bifida; in all other respects the child was well formed. The next day it burst, and many ounces of a blood-stained fluid escaped. The sac collapsed; no evil result following this bursting of the cyst. I watched the child for many months, and, on November 30th, 1871, the tumour had contracted up to an irregular indurated mass of integument. The child was a very healthy one.

Treatment. Excision.

Treatment.—The only right treatment is the excision of the growth, and this should be the general practice unless symptoms exist to contra-indicate any surgical interference, such as extensive or dangerous connections of the tumour. Care should always be taken to ascertain that no communication exists between the tumour and the spinal canal.

Fig. 68.

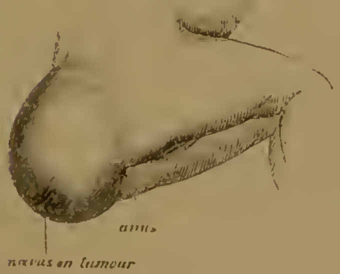
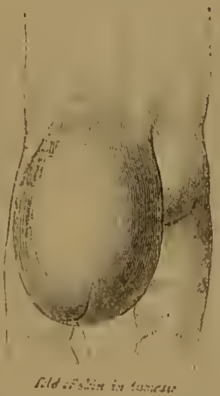


Fig. 68A.



Congenital coccygeal tumours.

Hewett, 'Med. Gaz.,' vol. xxxiv.—*Behrend*, 'Journ. f. Kinderkrankheiten,' vol. xxxi. —*Nélaton*, 'Path. Chir.,' vol. ii.—*Holmes*, 'Surgical Treatment of Children's Diseases,' 1869.

INJURIES OF THE SPINE, CONCUSSION, &c.

General remarks.

The spine is a flexible tubular column composed of ring bones, alternating with a dense elastic intervertebral substance; these bones articulate by means of joints, and are bound together by strong yet elastic ligaments. From the upper orifice of the tube the spinal cord with its membranes is suspended in a chamber filled with cerebro-spinal fluid, and surrounded by large venous plexuses. The cord and its membranes are held in position by the nerve-trunks that pass outwards between the bones with the processes of dura mater that accompany them.

Local spinal injury.

A local injury to the spine, such as a forcible bend forwards, may sprain or lacerate the ligaments that hold the bones in position. A still more forcible bend may crush the bodies of the vertebræ that form the anterior portion of each ring. If the force be still continued upon the broken bones, displacement may take place, when the delicate cord itself will either be slightly pinched between the displaced bones and contused, or completely crushed or divided. In the cervical and lumbar regions the bones may be dislocated, the amount of injury to the cord depending entirely upon the amount of displacement that has taken place. When the displacement is very slight the cord may be uninjured. Sprains of the back may also, at a later period, be followed by disease both of the joints and bones of the spine.

Diffused injury.

A diffused injury to the spine, such as that caused by a fall from a height upon the back or by a heavy falling body, or a severe shaking, as from a railway accident, may produce some fracture or dislocation of the bones of the spine, but it will to a certainty cause a severe shaking or concussion of the spinal cord itself, as manifested by a more or less complete suspension of all the functions of the cord, either for a short period or for life. This concussion of the spine may be accompanied by hæmorrhage into or upon the cord, giving rise to compression, or may be followed by acute or chronic intra-spinal inflammation, terminating in paralysis and death.

Gravity of case dependent on amount of lesion to cord.

In *both local and diffused injuries of the spine the gravity of the case depends chiefly upon the amount of injury the cord has sustained;* a severe local injury to the spine being quite capable of complete repair without endangering life, whilst any injury to the cord and its membranes is fraught with danger, either directly by suddenly arresting the functions of the parts to which the injured nerves are distributed, or indirectly by setting up chronic inflammatory changes in the cord.

Temporary paralysis.

When the functions of the cord have been directly suspended by any local or diffused injury of the spine, the patient is said to have suffered from *concussion of the spine.* Should the symptoms be complete and persistent, there is good reason to believe that the cord has been crushed by some displacement of a fractured or dislocated bone. Should some interval of time have taken place between the receipt of the accident and the paralysis, there is a fair suspicion that the paralysis is the result of some hæmorrhage into or around the cord. Should the paralytic symptoms have followed the accident after a few days, and have been attended with constitutional disturbance or spasm of the muscles of the limbs, the cause of the paralysis has probably been some inflammation of the cord and its membranes; and should the paralysis have been of a slow and progressive nature, the probabilities are that it is the consequence of some chronic softening of the cord; for all these different results have followed local and diffused injuries to the spine, and it is the knowledge that they may take place that renders any spinal injury a matter of importance, both from the immediate effects of the injury and its secondary consequences. In rare instances symptoms similar to tetanus follow spinal injury. I have seen such in

Persistent paralysis.

Tetanus after spinal concussion.

two cases. One case was that of a man, æt. 35, who fell from a height upon his head, bending the neck forwards. He was paralysed for a few hours from the neck downwards, and on the appearance of reaction he had marked tetanic symptoms with the contracted brow and risus sardonicus. Spasms could be excited on the slightest touch being made on his neck. In twelve hours all these symptoms disappeared, and a good recovery ensued.

In the second case a man received a crush in the loins, between two carts. Lock-jaw followed, with general spasms of all the muscles of the body. In five hours the spasms subsided, but they were followed for five days by hyperæsthesia of the integument, and on the sixth day by weakness of one leg. In a month he was convalescent.

Analogy between spinal and cerebral injuries.

Simple concussion.

Severe concussion.

Complete or incomplete paralysis.

In former chapters it has been shown that the functions of the brain may for a time be interfered with or suspended by a simple shake or concussion of its substance; that a severe concussion may give rise to contusion of the brain, both at the seat of injury or on the opposite side, by contre-coup; that extravasation of blood either upon the surface of the brain or within its structure may follow such an injury; that fractures of the skull are of importance in proportion to the severity of the intra-cranial complications; and that intra-cephalic inflammation is too frequently the result of any such injury. In injuries to the spinal column and its contents very similar results have to be recorded. A *simple concussion* of the spine may produce a partial or complete suspension of the functions of the cord; by rest and quiet these symptoms may disappear, and a perfect recovery take place. A *more severe concussion* may give rise to some injury of the nervous structure; to some extravasation of blood upon or into the cord itself. Such a complication will necessarily be associated with more marked symptoms, more complete and persistent paralysis and anæsthesia of that portion of the body supplied with nerves from the injured centre; the completeness and persistency of the paralysis and anæsthesia depending upon the severity of the mischief and on the seat of injury. When the paralysis is severe but *incomplete*, there will be retention of urine, this symptom arising from the loss of voluntary power over the muscles that regulate micturition. But when the paralysis and anæsthesia are *complete*, there will be absolute paralysis of the bladder and all its muscles, with incontinence of urine. This incontinence must not be confused with the dribbling of an over-distended viscus from retention, such as occasionally occurs in the less severe cases.

Symptoms according to regions injured.

When the injury is in the cervical region, one or both arms may be more or less paralysed; when in the lower dorsal, one or both legs; but, as a rule, the paralysis is symmetrical; the symptoms will depend upon the nerves that are involved. The loss of sensation is also generally complete. In one case, however, there may be paralysis of one limb and loss of sensation in the other; in a second, exalted sensibility with paralysis. In one the power of motion may be regained while that of sensation remains lost, and in another the reverse; indeed, on these points there is every possible variety, the seat of injury clearly determining the nature of the paralysis.

Brown-Séquard's observations on injuries to cord.

Brown-Séquard's observations and experiments on the decussation of the motor and sensory fibres of the cord have done much towards the elucidation of these points, and it may now with some confidence be asserted that when one antero-lateral column of the cord is divided or irreparably injured there will be motor paralysis of the same side of the body below the seat of injury, and loss of sensation upon the opposite side of the body. The motor paralysis being due to the destruction of the white substance, and the loss of sensation to that of the grey.

When any portion of the white substance is left intact some motion will remain, and when any part of the grey is uninjured some sensation. Complete division of the cord is necessarily followed by complete paralysis and loss of sensation in the parts below, although by what is called reflex action the muscles of the parts may be made to contract on the application of any stimulant, such as tickling, to the sensory nerves.

Pain in the course of a sensory nerve or in an extremity is to be taken as representing the irritation of the cord or nerve at its central origin, and, in cases of fracture, as the spot where the bone has been broken.

Cervical.

Erichsen asserts that a severe blow upon the upper cervical region may produce instantaneous death from concussion. That when the *vagus* nerve is affected, a sense of suffocation, with irregular action of the heart, or constant vomiting, may be produced. When the *spinal accessory* is affected, that spasm of the trapezius or sterno-mastoid muscles takes place, and that irritation of the *phrenic nerve* causes hiccup and the sensation of an iron band constriction round the body. When the injury is in the lumbar region, the paralysis is always partial, the cord terminating at the second lumbar vertebra.

Lumbar.

Temperature of paralysed side.

The *temperature* of the paralysed limb is always lower than the rest of the body, even when to the patient it may feel hot or burning.

Prognosis.

Depends on persistence of symptoms.

The *prognosis* in any case of concussion of the spine depends entirely upon the changes that are produced in the cord by the injury; and these are fairly to be measured by the severity of the symptoms and their *persistency*. This latter guide is a very reliable one, the persistency of symptoms being generally indicative of organic change. Again, when organic change has taken place the greater is the probability of some secondary inflammatory action in the injured part, and on this the prospects of the case hinge; for in injuries to the spinal cord or membranes, as in injuries to the brain, this intra-cephalic or intra-spinal inflammation is the cause of danger or of death in every case that survives the immediate effects of the accident, and it leaves, even when life is spared, more or less complete paralysis of the parts below the seat of injury.

INTRA-SPINAL INFLAMMATION.—SPINAL PARALYSIS AFTER CONCUSSION.—RAILWAY CONCUSSION.

General remarks.

Intra-spinal Inflammation.—"Every injury of the spine should be considered as deserving of minute attention. Inflammation of the cord and its membranes may supervene upon very slight injuries of the spine; it may advance in a very insidious manner, even after injuries that were of so slight a kind that they attracted at the time little or no attention."

Thus wrote Abercrombie in 1829, and his observations are as true now as they were then. Upon such views the whole treatment of injuries to the spine, simple or severe, ought always to be based.

The preventive treatment of spinal as of head injuries, means the adoption of such measures as experience has proved are most valuable in warding off the accession of intra-spinal and intra-cephalic inflammation, and thus preventing paralysis. The simplest shock or concussion of the spinal cord; the slightest blow upon the spine or sprain of its ligaments; any bruising of the former or laceration of the latter; and, much more, any severer lesion, is apt to be followed by an acute or chronic intra-spinal inflammation and by changes in the structure of the cord that may give rise to a paralysis, partial or complete. The Surgeon has, moreover, no guide by which to measure the danger or calculate the probabilities of the occurrence of this secondary inflammation; it may follow a slight accident, and fail to follow a severe one, although, in a general way, the prospects of its appearance and its danger depend much upon the gravity of the injury.

Proneness to secondary inflammation of cord.

When the cord has been much contused or crushed by a fractured or dislocated vertebra, the paralysis that necessarily follows such a lesion is not likely to be aggravated by any secondary inflammatory changes in the injured cord, although the end of the case may be hastened by these changes. Under such circumstances, the complication is not of such a nature as to add to the Surgeon's anxiety. In less severe examples of injury, however, in which the primary symptoms do not indicate any organic lesion beyond that which manifests its presence by some temporary suspension of the functions of the cord, it becomes a matter of primary importance for the Surgeon to recognise the very earliest indication of inflammatory action, in order that it may be arrested; for as it has been shown that the chief aim of the Surgeon in the treatment of all these injuries is to prevent the occurrence of inflammation, so the second is to arrest its progress as soon as it has appeared. When it has become thoroughly established, neither medical nor surgical art has much power in either checking its progress or in correcting its effects; for the delicate structure of the spinal centres appear to be incapable of undergoing material repair when softened by disease or crushed by accident; the cord structure when once destroyed being never replaced, repair taking place only by means of a fibrous change. Paralysis or loss of function, under these circumstances, is permanent. In any case, therefore, of spinal injury, when the symptoms are persistent or tend to get worse; when after their disappearance—partial or complete—after an interval perhaps of three or four or more days, they reappear, or appear in some altered form; when local pain is aggravated, movement of the back is difficult or distressing; when pain follows the course of the nerve trunks that emanate from the injured spinal centre; when muscular spasm or paralysis is present; and constitutional disturbance or general febrility; when any or all of these symptoms, few or many, are found to follow any injury after the first effects of the accident have passed away, the diagnosis of secondary inflammation may fairly be made, and action taken upon it.

Necessity of recognising earlier symptoms.

Symptoms of spinal inflammation.

In general concussions of the spine, more particularly in railway accidents, when by some general shaking of the body, the spinal, cerebral, sympathetic, and circulatory systems are all more or less involved, there is an undoubted disposition for a chronic inflammatory change of a most insidious and creeping kind to take place; but the symptoms of secondary action are as obscure as are the primary that follow the accident.

Insidious nature of the symptoms.

Symptoms often masked.

The primary spinal symptoms, it is now well known, are often so mixed up with the general that they are really masked; and beyond a general and temporary loss of power and consciousness there are often no special symptoms by which spinal mischief is manifested. After recovering from the shock of the accident and the mental disturbance the sufferer often feels no definite injury, no local symptoms; and it is not till some time has elapsed—the duration of which is uncertain also—that any special symptoms make their appearance.

Symptoms vague and indefinite.

These symptoms are, again, as were their antecedents, vague and indefinite; the patient, it will probably be found, has never been himself since the accident; he has been unable to work, mentally or physically, with the same force or energy that he did before; he has been irritable in his manner, and perhaps feeble in his powers. Sleeplessness has been more complete or common than it was before, and headache, with general malaise, now often exists.

Premonitory symptoms.

Some slight unsteadiness of gait is often the first observed symptom, a feeling of heaviness in the limbs, some abnormal sensation, such as that of pins and needles, numbness along the course of a nerve, cramps, perhaps retention of urine, some evidence, in fact, of want of control or power over the muscular apparatus, more marked generally in the lower extremities than in the upper. The centres of sensation will, at the same time, show indications of disturbance, either by a state of lessened sensibility, or perhaps by a hyperæsthetic condition. By symptoms such as these the attention of the Surgeon is probably arrested. On testing the muscular apparatus thoroughly, it will probably be found that the patient will be unable to stand steadily on one leg, or, what is a better test, if he puts his heels together he will totter on making the attempt to raise his body on his toes. When asked to stoop to pick up anything from the ground, he will probably bend his knees rather than his back; and he will walk with a rigid spine. On giving him a small object, as a pin, to take, he will take it clumsily, and with tremor; he will fumble at most things, as he will stumble at anything that comes in his way.

Affection of the muscular system.

Local signs.

On examining the spine some tenderness may be felt on firm pressure, and this will probably be in places only. Percussion upon the bones is hardly a fair test; when employed, it should be indirect, through the fingers. At times pressure applied to the spine causes severe pain, as does any movement, this latter symptom causing the rigidity of the spine to which attention has been directed.

Cerebral signs.

The brain and the organs of special sense may likewise be affected, either by over or under sensibility. *Vision* may be imperfect either in one eye or in both; *hearing* may be over-sensitive or defective; *taste* and *touch* may be perverted or lost; and *smell* is at times destroyed or morbid. In fact, the whole nervous system, cerebral and spinal, may be disturbed, and its functions more or less damaged.

Progress uncertain.

The course such cases run is very uncertain, and it is difficult to give a decided opinion. When the motor power has been lost from spinal mischief, the best test is galvanism. A healthy muscle supplied from a healthy nerve centre will always contract on the application of the galvanic current. When the nerve centre is so diseased as to cause paralysis, the galvanic current produces no movement—no contraction. This test is beyond the patient's control, and cannot be resisted; it is therefore a very valuable one.

Galvanic test.

Caution in interpreting symptoms.

In interpreting these symptoms, more particularly in a railway case or in any in which the question of damages is involved, it is most important for the Surgeon to separate the symptoms of which the patient complains—the *subjective*, from those he can himself perceive—the *objective*. Let him doubt and cross-examine upon each of the former in every way to test their accuracy. He may rely upon the latter, and any positive opinion ought to be based upon them alone. There always hangs a film of suspicion over the former class of symptoms, because self-interest points to a supposed advantage by making the worst of them.

Subjective and objective symptoms.

All the symptoms, taken as a whole, undoubtedly indicate a chronic or subacute inflammatory change of nerve-tissue, an inflammation of the membranes or of the cord. When they appear as a consequence of a general concussion of the spine the cord is probably the seat of mischief, its delicate structure being more liable to injury—and consequently to secondary changes—than the tougher membranes. When they follow some local injury, some twist, blow, or forcible bending of the back with laceration of ligaments, it is probable the disease in the cord is secondary to disease in the membranes, the inflammation of the latter being due to the extension of inflammatory action from the injured part inwards. "Inflammation of the membranes of the cord, as of the brain, is a disease not idiopathic, but proceeding from some cause without" (Wilks). But wherever this commences it is a progressive one, and in the end involves all the tissue in its destructive changes.

Myelitis.

Spinal meningitis.

The pathological changes themselves are tolerably definite. In the cord they put on the appearance of red softening in recent disease, of white in chronic. The parts are soft and pulpy, and the microscope shows them to contain granule-corpuscles and elements of the inflammatory process. At times the white matter of the cord will appear to be sound, when the grey substance is soft. The disease may be local or more general. In concussion the latter is the more common condition. When it is in the cervical region death is rapid, when in the lower dorsal life may be prolonged for some time. This fact is well illustrated in fracture and dislocation of the spine.

Pathological changes.

TREATMENT.—In all cases of concussion of the spine, simple or severe, *absolute rest* in the horizontal posture is most essential, and in mild cases this is probably the only treatment that will be called for; the symptoms, by the observance of this rule, gradually disappearing, and the health becoming restored. The Surgeon must, however, enforce quiet for some days after the disappearance of all symptoms, for until some ten or fifteen days have elapsed after an apparent recovery, even in the mildest cases, there is danger of intra-spinal inflammation, and in proportion to the severity of the symptoms is the period of rest after the accident to be enforced. The prone position in more severe cases is generally to be preferred to the supine, but the best guide to the Surgeon in this matter is the ease the patient experiences. In cases of railway concussion this practice is of primary importance, and it is a question how far those obscure examples of spinal paralysis and other symptoms after railway accidents are due to the non-observance of this rule. It is true that in the majority of cases there are no definite indications of spinal concussion after the accident; but the nature of the accident itself is a sufficient guide to the case. A general shaking of the body means a general concussion of the spine with every other

Treatment.
Importance of rest.

part, and the nerve centres by reason of their structure are most liable to injury. It would be well, therefore, to keep all patients who have been the subjects of such injuries quiet and in repose for several weeks after the accident. By doing this, doubtless, much mischief would be avoided.

Cupping, &c.

When after concussion severe local pain is present, relief is often given by the application of a dry cupping glass on either side of the painful part, and this operation may be repeated. In exceptional cases the local extraction of blood may be found of benefit. The ice-bag is a powerful remedy for good when there is much effusion of blood or pain in the part, and when the symptoms of reaction are too marked.

The diet should be nutritious, but unstimulating, and nothing likely to keep up or cause mental or physical excitement allowed. When recovery of power in the limbs is slow, and no symptoms of secondary inflammation of the cord exist, convalescence is promoted by the application of electricity in some of its forms to the enfeebled muscles.

Mercury.

Iodide of potassium.

Strychnine.

Iron.

When symptoms of intra-spinal inflammation have appeared, in addition to the above treatment some Surgeons advocate moxas or setons; of the two the moxa is, perhaps, the preferable form. Mercury in one of its forms appears to be a valuable remedy, and the perchloride is, perhaps, the best preparation, given in doses of 1-16th of a grain two or three times a day, combined with bark, quinine, or some other vegetable bitter according to the wants of the patient. When mercury is inapplicable the iodide of potassium should be substituted. Sedatives should be allowed to procure sleep, and the hydrate of chloral seems to be the best, in twenty or thirty grain doses, at bedtime. Should pain be constant, fifteen grains of the same drug may be given twice a day, a double dose being allowed at night. Belladonna in one third of a grain or half-grain doses is likewise a valuable sedative. Strychnine is a dangerous drug in spinal disease, at least in progressive spinal disease; it is a distinct stimulant to the spinal centres, and is, consequently, most injurious as long as any progressive inflammatory action exists; when only the effects of the disease remain and all inflammation has ceased to manifest its presence, strychnine may be given. Should general feebleness exist, iron may be given with it; and I know of no nervine tonic so good as the combination of the tincture of the perchloride of iron in doses of fifteen minims, with five minims of the tincture of nux vomica or one or two grains of quinine. Cod-liver oil is a valuable adjunct to all treatment in this as in many other cases.

Avoid bedsores.

Great care should be observed throughout the treatment of these affections to prevent the occurrence of bedsores. They form very rapidly when spinal paralysis is present. I have seen several instances in which all the soft parts over the bones sloughed, and the spinal canal was opened; in others the sacral bone may partially exfoliate. The back should be kept very clean and dry and sponged occasionally with spirit lotion; it should also be protected by leather strapping, felt plaster, and by good cushions of air or water.

When retention of urine complicates the case, the utmost caution is required in passing the catheter. An elastic instrument should be preferred and of a large size. The French vulcanite catheter is, however, the best.

FRACTURES AND DISLOCATIONS OF THE SPINE.—WOUNDS AND SPRAINS.

Fractures and dislocations to be considered together.

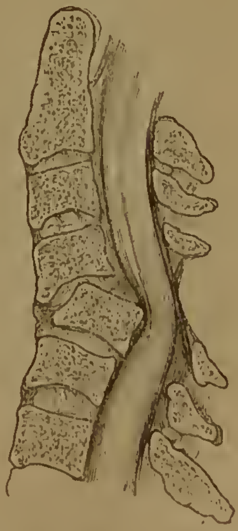
In a practical point of view it is expedient to consider fractures and dislocations of the spine together; they are not, however, invariably combined, for although in four fifths of the injuries to the spinal column involving the bones some fracture is present, in the remaining one fifth simple dislocation exists. The majority of these cases of pure dislocation occurs in the cervical region; in the dorsal such a thing is almost impossible, and in the lumbar it is very rare. The difference in the anatomical arrangement of these divisions of the column affords an explanation of these facts. To the practical Surgeon these points are, however, of small importance; what concerns him most in any injury to the spine has reference to the cord—how much injury has it sustained? Is it reparable or irreparable?

Injury of the cord the main point.

Symptoms, &c., vary according to region.

When complete paralysis follows the injury there is little doubt that the cord has been injured. It may be that it has been more or less completely crushed by displaced bone, or even divided. In less severe injuries less severe symptoms show themselves. Injuries to the cervical region are of greater danger than those of the dorsal, and these again are of more importance than those of the lumbar. The nearer the injury is to the respiratory centre, the greater is the danger. Any crushing of the cord above the third cervical vertebra is, as a rule, followed by instant death; this point being above the origin of the chief respiratory nerve, the phrenic. In cases of injury to the cervical vertebra giving rise to any symptoms of paralysis, death generally takes place within three days, and commonly within two. Thus, out of 36 fatal cases extracted for me by Mr. Rendle from the Guy's Records, 25 died in less than seventy-two hours, and 20 of them in less than forty-eight; 8 cases only survived the former period, and in those there were no symptoms of paralysis as an immediate result of the accident. Eleven of the 36 were cases of pure dislocation, 25 were examples of fracture and dislocation combined, and all were below the third cervical vertebra; in every case, also, of dislocation the upper vertebra was thrown forwards upon the lower, as seen in Fig. 69. Where spinal symptoms resulted the cord was more or less pressed upon—in some instances crushed, in others bruised.

Fig. 69.



Dislocation of the spine.
Guy's Hosp. Mus., No. 1033.

Fractures of the dorsal and lumbar vertebræ, associated with displacement, and giving rise to paralysis below the seat of injury, are less speedily fatal than are those of the cervical region.

Fracture of the spine may, however, take place and not be associated with any paralysis; the spinous processes of any of the vertebræ may be fractured, and no spinal symptoms follow; this accident is generally the result of a direct blow. When I was a dresser I saw a case of fracture of the spinous processes of three cervical vertebræ associated with a temporary paralysis, and in this instance complete recovery ensued; and I have since treated successfully a case of fracture and displacement of the spinous process of the fourth cervical vertebra without paralysis.

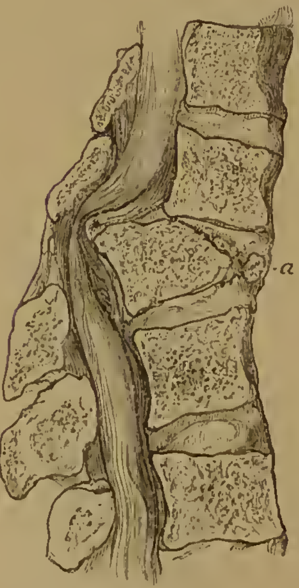
May escape detection.

In other cases fracture of the spine may take place and not be detected until after death. Examples of this are not uncommon. In such the cord is not involved, nor any of the nerve trunks. The following case well illustrates these points.

Example.

In 1857, a woman, in an attack of mania, was admitted into Guy's under the care of Mr. Cock, for some contusion of the back caused by a fall out of a window. Beyond the contusion no injury could be made out. There was no paralysis, but, on the contrary, violent muscular movement, the woman being maniacal. On one occasion she got out of bed and struggled to open a window to throw herself out. She lived sixteen days, and for the last week of her life rested quietly in bed, with her eyes closed; she would only at times rouse herself and speak. After death, atrophy of the brain was found, with general fatty degeneration of the viscera. The last dorsal vertebra and three upper lumbar vertebræ were fractured through their bodies, but not displaced; one or two spinous processes were also fractured. The spinal marrow was uninjured. The fact of there being no displacement of the broken bones, and no injury to the cord, prevented a correct diagnosis being made.

FIG. 70.



Fracture of spine.
Guy's Hosp. Mus., No. 1035^{25}.

I have also seen a case of fracture of the spinous processes of the last dorsal and the first lumbar vertebræ with lateral displacement, the injury having been treated for some months previously as a simple contusion of the back. In this case no paralysis existed, or other spinal symptoms.

Generally the result of indirect forces.

Fractures and dislocations of the spine are generally the result of *indirect forces*, such as severe falls. A forcible bending forwards of the cervical spine may cause dislocation of the cervical vertebræ, and a similar accident to the dorsal spine may cause fracture; and in these cases there is always some laceration of the ligaments and crushing of the anterior edges of the bodies of the vertebræ. (*Vide* Fig. 70.) A forcible bending backwards of the spine may produce a like result, the laminæ of the dorsal or lumbar vertebræ, under these circumstances, being much broken. Direct violence to the spine in the cervical region may cause dislocation; in the lower vertebræ it generally causes fracture of the spinous processes or laminæ. Mr. Holmes has recorded in the 'Path. Soc. Trans.,' vol. x, an interesting case of displacement of the last dorsal from the first lumbar vertebra associated with some slight fracture of the processes the result of a direct blow.

Fracture of the sternum is not uncommonly associated with injuries to the spine from the forcible bending forwards of the head; it was found in four out of fifty-six fatal cases that occurred at Guy's.

Statistics of 56 cases.

Of these fifty-six fatal cases of fracture and dislocation of the spine, thirty-six were of the cervical region—eleven being examples of pure dislocation—eighteen of the dorsal, and two of the lumbar; injuries of the cervical being apparently twice as frequent as those of the dorsal region; the greater mobility of the cervical vertebræ and the horizontal aspect of their articular processes favouring dislocation.

36 cervical.

In the thirty-six cervical the injury was below the third vertebra in all but three examples. In one of these it involved the second, third, and fourth vertebræ, in another the arch of the atlas and spinous processes of the second and third, and in the third case the bodies and arches of the third, fourth, and fifth vertebræ.

18 dorsal.

In the eighteen dorsal, seven were in the upper and eleven in the lower half, the lower cervical and the lower dorsal regions being clearly more liable to injury than the upper.

When the cord was sufficiently injured in the cases of injury to the cervical region to give rise to paralysis, death generally took place within three days, and in the majority of instances within two.

When it occurred as a result of injury to the dorsal region, suppuration of the kidneys, cystitis, or bedsores were the most common causes of death.

11 cases of pure dislocation of cervical.

Of the eleven cases of pure dislocation of the cervical vertebræ, four were between the fourth and fifth; two between the fifth and sixth; three between the sixth and seventh; and two between the seventh cervical and the first dorsal. In none of these was there the smallest trace of fracture. In six the displacement was so great as to crush the cord. In five there was no displacement and no marked paralysis as a direct result of the injury, although secondary paralysis appeared subsequently from stretching or other injury to the cord.

In injuries to the cervical region, pure dislocation occurs in thirty per cent. of the cases.

Dislocation of upper cervical.

Cases of sudden death after a fall from a height upon the vertex are doubtless often due to a fracture or dislocation of the cervical spine. It may be a fracture of the processus dentatus of the axis; a laceration of the transverse ligament binding it in position; or a fracture of the atlas allowing the head to slip forward. Dislocation of the occipital bone from the atlas has been described; it is, however, very rare.

Fracture of odontoid process.

When fracture of the odontoid process takes place, as it may do from external violence, or during the progress of some disease in the vertebræ, death as a rule occurs suddenly; the victim being literally pithed. Whilst in other cases—and these are generally of disease—the displacement may be gradual; death being then often preceded by paralysis of an arm or leg, or both, difficulty in swallowing, inability to raise the head into the erect position, or to rotate it, and pain in the neck.

Vide paper on fractures of the odontoid process, by Dr. Stephen Smith, of New York ('American Journal of Med. Sci.,' October 1871).

Diagnosis.

Diagnosis.—When a patient has received a severe injury to the spinal column, followed by complete paralysis, there can be little doubt that the cord has been injured, and that a fracture or dislocation, with displacement of the vertebræ, has taken place. When the paralysis is partial, it is probable that the cord has been only partially involved, more or less bruised, or stretched, according to the nature of the accident; the amount of injury to the cord depending entirely upon the extent of the displacement of the injured bones. When no paralysis is present the diagnosis is difficult.

When any inequality or irregularity in the spinous processes is present; any pain in one spot aggravated by pressure; any crepitus on manipulation; any local effusion of blood about the spine; any inability to move the spine or support the body; when priapism appears early in the case; when one or more or all of these symptoms come on after such an accident as is prone to produce them, the diagnosis of a fracture or dislocation is tolerably clear.

When paralysis of one arm or leg follows a spinal injury, it is possible that the paralysis may be caused by some partial displacement of the injured bone, by pressure upon one or more of the nerves that pass outwards from the spine, or by laceration of a nerve trunk. When paralysis is incomplete, the motor power is generally more completely lost than that of sensation; indeed, it often happens that there is hyperæsthesia in that portion of the body contiguous to the paralysed part, the portion of cord which is above the injured part being overactive or irritated by the sharp parts of the fractured bone; intense pain in the line of junction of the paralysed and non-paralysed parts signifying fracture in Mr. Erichsen's opinion. In estimating the seat of injury from the position of the paralysis, it is right to remember that the nerves come off obliquely from the spinal cord and pass downwards, the nerve trunks leaving the spine one vertebra or two vertebræ lower than the spot whence they are given off; also that the cord terminates at the second lumbar vertebra. Thus, when fracture takes place below the second lumbar vertebra, there may be no paralysis. The patient may be unable to stand or walk wholly or in part, but put him on his back and there will be free movement of his legs. In other cases the nerve trunks of the cauda equina may be involved.

Increase of temperature.

When a patient has received a severe spinal injury, there may or may not occur what is called "shock;" but when these symptoms have passed off and those of reaction appear, there will commonly in cervical injuries exist some throbbing of the arteries of the paralysed parts and increase of their temperature, these conditions being due to paralysis of the arteries as a result of injury to their vaso-motor nerves. At a later period, however, this increase of temperature subsides, and a diminution is to be detected. In exceptional cases the vaso-motor paralysis is associated with coldness of the parts, and it is probable that when this coldness exists it is due to great depression of the heart's action.

Prognosis in cervical injuries.

Prognosis.—The nearer the injury is to the respiratory centre the greater is the danger to life. Thus, in injuries to the cervical spine, above the origin of the phrenic nerve or third cervical vertebra, causing paralysis, death may be instantaneous; but when below this position, the respiratory process is maintained only through the diaphragm, and life is rarely prolonged beyond the third day, and, as a rule, not beyond the second. Mr. Hilton has, however, recorded in his lectures

'On Rest' a case in which a man lived for fourteen years completely paralysed from the neck downwards, after a fracture of the cervical vertebræ; and a gentleman, aged twenty-nine, whom I saw with Mr. Roberts, of Southgate, November 25th, 1870, with complete paralysis of the whole body below the fifth cervical vertebra, caused by a fall upon the neck, was still alive in 1875, breathing solely by the diaphragm.

In dorsal or lumbar injuries.

When the cord has been injured in the lower dorsal or lumbar region, life may be prolonged for many months, the immediate cause of death being generally some renal or vesical mischief, some bedsore or other complication the direct result of loss of nerve power in the paralysed parts; the longer these complications are delayed by careful nursing and attention, the longer will life be maintained.

In other cases, again, in which only partial paralysis or none at all is present, as a direct consequence of the injury, inflammatory changes may ensue in the injured part, and, spreading upwards, cause death: the prognosis in such instances will be mainly determined by the seat of the injury and the extent of mischief in the cord.

Rules as to prognosis.

The lower the seat of injury the better are the prospects of a cure; the less the cord is involved in the mischief the greater are the chances of a recovery.

Thus fractures of the lumbar region are quite capable of a complete cure, and fractures of the lower dorsal vertebræ are not infrequently recovered from. Injuries to the cervical spine are generally fatal within three days. Injuries to the dorsal, when not proving fatal within the third week, may be survived months, or even years, the duration of life being greatly determined by the warding off of the secondary complications which so frequently arise.

Care in manipulation.

TREATMENT.—The diagnosis of a fracture or dislocation of the spine having been made, the most essential point of practice to be observed is that the part be kept absolutely unmoved; the patient should be examined with the greatest care, and moved with all possible caution, for any motion will necessarily add to the injury the cord has sustained, and increase the danger of the case. Any manipulation of the injured part, beyond the gentlest, is to be condemned, as being likely to prove hurtful. Extension of the spine may be employed when much deformity exists, or when severe pain arises from nerve pressure, but extreme caution is required in following this practice; it is not to be employed in every instance, but only when local symptoms seem to suggest the probabilities of a successful issue. I have seen several cases in which marked relief was afforded by this practice, and the records of surgery contain many more. Practised with discretion, extension of the spine is doubtless a valuable means of treatment.

Extension in exceptional cases, good.

Absolute repose in the horizontal posture is an essential point of practice to be observed. When the patient is placed upon his back, the parts have a natural disposition to fall into place; this position, therefore, must be maintained. The bed should be firm, yet elastic; a water bed is the best, when it can be obtained; otherwise, a spring mattress or one of horsehair should be employed; it must be well protected by water-proof cloth, &c., from all contact with urine or fæces.

Retention to be relieved.

The condition of the bladder should be looked to from the very first. Retention is sure to be present for a time, and over-distension is most injurious. The utmost care ought to be employed in drawing off the water. A moderate-sized elastic or the French vulcanite catheter should be used; and the operation repeated twice a day, night and morning.

Washing out of bladder.

If the urine become offensive, the bladder must be washed out; no syringe should, however, be used. A stream of water should be allowed to run in and out of the bladder through an elastic tube fitted to the top of the catheter, no force being allowed. (*Vide* Fig. 276.) The application of leeches to the spine, cupping, &c., is seldom called for. The condition of the bowels must be looked to, and enemata are to be preferred rather than purgatives. The greatest care is needed to keep the patient clean, particularly when incontinence exists.

Treatment.

There are no special medicines applicable to these cases. The general health of the patient must be maintained by tonics and simple nutritious food; sedatives should be given to procure rest and relieve pain.

Avoid bed-sores.

The condition of the back must be daily looked to, for the prevention of bedsores. This is best ensured by taking away pressure, as far as possible, or by relieving it by means of soft cushions and pads, the water cushion being the best, and by keeping the parts dry. The application of a soft felt plaster over the sacrum and hips is sometimes of use, as is also the frequent application to the parts of some spirit lotion. Should it be necessary to turn the patient on one or other side, the attendants must be taught to rotate the hips and shoulders at the same time. By great care and attention life may be prolonged, and even a recovery secured.

Question of trephining.

The subject of trephining the spine requires a brief consideration. Cline was the first Surgeon to put it into practice, and on his great authority the operation has been repeated, but with no success. The great argument against its use is derived from the fact that in few post-mortem examinations has the condition of parts indicated that the slightest good could have been derived from its performance. When the cord is much injured by the accident the mischief has been done, and no removal of the displaced bone can undo it, or neutralise its evil. If the cord is not injured no operation is called for.

The danger of a fractured or dislocated spine lies in the injury to the cord. This injury to the cord is the result of a stretching or crushing of its substance by the accident. The displacement of the bones is rarely permanent, it is only temporary, and even when it is permanent, no good can accrue to the cord itself by its removal. The portion of the vertebra displaced is generally its body.

Example.

One successful instance of trephining is recorded by Dr. Gordon, of Dublin, and in rare and exceptional cases it is possible the operation may be justifiable. To perform it because it may by chance do good is not sound practice. The onus of proving that an operation is likely to be of use always devolves upon the Surgeon before it should be undertaken. There is, however, reason to believe that a cord may at times be only squeezed or pressed upon by effused blood, and under such circumstances relief might be afforded by removing enough bone to take away the pressure, and thus give the cord a chance of recovering itself.

Removal of portions of bone.

In the case of the young man referred to at p. 271, such a probability seemed reasonable, and three months after the accident I cut down upon the injured vertebra, and removed the spinous process and lamina of the fourth cervical, exposing the cord. No harm followed the operation, although no immediate good was produced. The wound healed rapidly, and in the course of a few weeks some slight power returned in the muscles of the shoulders, the patient being able to raise the arms from the bed. He, however, made no further progress; still, the case is an encouraging one.

Le Gros Clark's remarks.

"The end proposed in an operation of this kind," says Le Gros Clark, "is to remove displaced bone which is supposed to press upon or irritate the cord; but it is most likely to prove abortive from the inaccessibility of the displaced bone. If the cord have been crushed, and the operation have been consequently useless, probably life may thereby be only curtailed, but if the cord be not crushed, it appears to me that the best chance of the patient's recovery is thereby extinguished. Indeed, my conviction is that the operation has been advocated on the erroneous hypothesis that the spinal cord can be compressed without serious disintegration of its texture."

Wounds of the spinal cord.

Wounds.

These are very rare in civil life. They may, however, take place as the result of a stab or a gunshot wound. Should the cord be injured, some symptoms of paralysis will appear, corresponding to the part that is involved, the extent of the paralysis and its seat fixing the position of the wound.

Sprain of the back.

Sprains and their varied effects.

The word sprain is a very broad one, and when applied to the back is very vague. It may mean simply a stretching of the muscles or ligaments of the back, or a more complete laceration of the latter, and separation of the spinous processes of the vertebræ with exposure or injury of the cord. The number of articulations in the spine—nearly eighty—renders such an accident as a sprain a common one; any twist of the spine, any forcible flexion, may consequently injure some of these joints. Sprains may, moreover, be followed by acute or chronic joint disease of a serious and insidious nature. When the head is bent violently forward, the muscles and ligaments may be so torn as to give rise to the effusion of blood, swelling, and severe local pain. When the body is flexed with violence not sufficient to give rise to fracture, the same result may take place, and also when a man falls upon his buttocks. In both these cases there may be external evidence alone of injury, or there may be evidence of some affection of the cord, such as that afforded by the presence of paralysis, proving that the cord has been stretched, if not permanently injured. Should the symptoms rapidly or even gradually pass off, no grave mischief has probably taken place. Should they be persistent or obstinate, a less favorable opinion should be formed. When the lumbar region is the part involved, it is not uncommon for hæmaturia to appear, and this may be slight and pass away, or be more persistent. It is not, however, a very serious symptom, unless the kidney is ruptured, for, as a rule, it disappears gradually, and no evidence exists that organic renal disease is ever the result. "Of the many cases I have witnessed," says Le Gros Clark, "I have never had reason to suspect that nephritis or organic disease followed." ('Brit. Med. Journ.,' Oct. 3rd, 1868.) Mr. Shaw, in 'Holmes's Surgery,' gives a case where the bleeding lasted for four days, ceased for two, and then reappeared in all its severity. After two more days it again ceased for twenty-four hours, to reappear for a

Hæmaturia.

third time in quantity, when it stopped, and a good recovery ensued. When the kidneys are diseased, and also when calculi exist in them, this symptom is more likely to appear after injury.

Hæmorrhage into spinal canal.

Hæmorrhage may take place into the spinal canal, as the result of a sprain, or laceration of the ligaments, the blood probably flowing from a laceration of some of the large veins that surround the cord or from a spinal artery. Mr. Hewett has related a case of sudden death from a fall upon the head, recorded by Dr. Deville in 1843 ('Mém. de la Soc. de Chirurg. de Paris,' t. iii), in which no other injury was found to the nervous centres than hæmorrhage into the canal in its whole length. Mr. Le Gros Clark has recorded a second, in which a man was struck violently on the back, but there were no immediate spinal symptoms. Paraplegia, however, soon followed, which extended upwards and destroyed life by asphyxia, and after death the theca was found distended with fluid blood, derived from a ruptured spinal artery. He gives also another case, somewhat similar in symptoms, though not in result, and in this the patient recovered after two years.

Treatment.

TREATMENT.—In all these cases of sprain, slight or severe, rest is essential, the patient being allowed to assume the position in which he finds the greatest ease. The application of ice in a bag is also of great value where much swelling or pain exists. In other cases a warm poppy fomentation gives relief, or a mixture of belladonna and opium rubbed down with glycerine and applied on lint. When spinal symptoms are present the greatest caution is needed, and the case must be treated as one of concussion of the cord.

Preventive treatment is all important, to ward off secondary inflammatory changes, both of the spine and cord.

Rest in the horizontal position for seven or eight weeks is an essential point in all severe cases, and, even in the milder forms, exercise must be sanctioned wih caution.

When hæmaturia occurs it requires no special treatment, except when severe. Gallic acid, in gr. v or gr. x doses two or three times a day, may then be given, but, as a rule, this is not needed.

CURVATURE OF THE SPINE.

There are two forms of curvature of the spine, the *lateral* and the *angular*. The *lateral* is due to a relaxation of the ligaments and muscles of the spine which in a healthy subject maintain the bony column in its normal position. The *angular* is caused by organic disease of one or more of the bodies of the vertebræ, or of the intervertebral substances. It is generally known as "Pott's curvature."

Lateral curvature.

Lateral Curvature.

This is by far the more common of the two. It is generally found in girls between ten and twenty years of age; sometimes in young children, and it is frequently, but not always, associated with some want of power. It is more common in the middle and higher classes of society, where sedentary occupations and luxurious enervating habits too often exist, than in young women who have full use of all their muscles and lead an active life.

Early symptoms.

It is encouraged by any one-sided posture of the body, whether this be the result of some faulty habit or occupation; of over-use of one limb, or of any disease or deformity of a lower extremity occasioning shortening of the limb.

In its early stage it is seldom discovered, and attention is, as a rule, drawn to the disease by some "growing-out" of one shoulder, generally the right, some distortion of the chest, or some tilting upwards of a hip. These deformities are frequently first noticed by dancing or drill masters. When a curve has taken place in the upper dorsal region of the spine to the right side, a compensatory curve is certain to be found in the lumbar to the left. In investigating a case it is important to bear this fact in mind, for the consecutive or compensatory curve, unless of long standing, will soon be remedied when the original one has been cured.

Deformity.

In some subjects there exists an exaggeration of the natural curves of the back; when it is in the upper dorsal region and backwards it is called *cyphosis*, when in the lumbar and forwards *lordosis*. This latter curve is very frequently found as an accompaniment of hip disease, and is compensatory; it is also present in organic disease of the spine, and in *rickets*.

Rotation of spine usually present.

Associated with the lateral curvatures there must necessarily be some rotation of the spine. The amount of this is very variable, and depends upon the extent of the curvature; it is, doubtless, due to the forcible bending of the bones downwards with the ribs, these latter helping to rotate the vertebræ upon their axes. The bones may be so twisted that their transverse processes project backwards, carrying the ribs with them, the anterior surfaces of the bodies of the vertebræ looking towards the convexity of the curve, and the spinous processes laterally towards the concavity. The thorax is thus much distorted, the side corresponding to the curve being expanded, and the opposite one greatly contracted. This is well seen in the annexed drawings, Fig. 72 taken from a living patient, and Fig. 71 from a preparation.

FIG. 71.

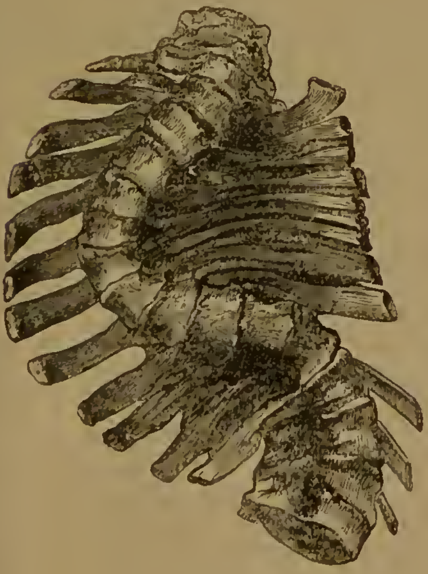
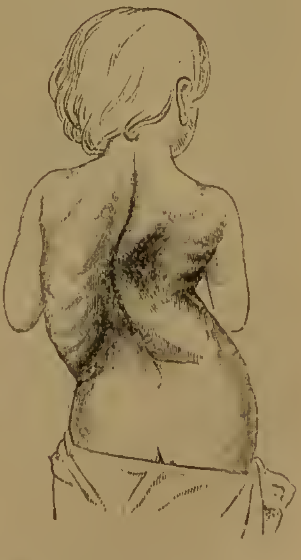


FIG. 72.



Lateral curvature of the spine.

Anterior view.

Posterior view.

Guy's Hosp. Mus., No. 1000^{60}. Taken from Emma J—, æt. 14.

Diagnosis.

The diagnosis is not very difficult when the deformity is well developed. The double curve giving the spine a sigmoid form marks its nature. In less severe examples this curve can readily be removed by extension of the body, or by lifting the patient from the ground by a hand in each axilla. In the severer forms, such as that shown in the above drawing, the deformity is permanent. The ribs are thrown out in an extreme degree, pushing the scapula outwards and upwards, and the lumbar curve is very characteristic. The whole thorax, abdomen, and pelvis are altered in shape and position by the deformity.

Treatment.

TREATMENT.—In treating these cases it is necessary in the first place to determine the cause of the deformity. Should there be any structural disease, such as a growth, or carious bone, these will require attention, and the alteration in the spine becomes a secondary matter. But in the great majority of cases of lateral curvature the spinal affection is the result of impaired health, and constitutional remedies are demanded. The treatment must be directed to an improvement of the general health, and tonics, such as iron, quinine, and cod-liver oil, should be given. Good air and good food are essential, and some local treatment is a valuable aid.

When due to debility.

The feeble muscles and weakened ligaments are to have rest; they are to be kept in health by moderate exercise, but are never to be fatigued; should fatigue be experienced by walking one hour, such exercise must be curtailed to a shorter period. Should backache be produced by exertion, less must be taken. Exercise is to be allowed, but only to an amount short of producing fatigue. Sitting and standing are not to be sanctioned. The patient should recline at stated intervals in any position that gives the greatest ease. When the deformity is definite, and the dorsal curve is to the right side, as is nearly always the case, the patient should rest upon that side with a pillow beneath the right arm; the weight of the body then acts as an extending force upon the curved spine, and thus tends to reduce the curve. By adopting this practice two or three times in the day for a definite period, depending upon the nature and severity of the affection, much good may be obtained, and very severe curvatures remedied. Cold sponge or shower baths, as they can be borne, are always good, and a moderately firm bed: a spring mattress is better than a feather bed. Gentle calisthenic exercises are valuable adjuncts to treatment when practised with discretion; but it is to be remembered that a weak spine is being dealt with, and anything like violence may be most detrimental.

General objects of treatment.

The objects of treatment are, therefore—1. To improve the general condition of the body. 2. To give rest to the strained and weakened muscles and ligaments. 3. To strengthen the muscles that support the spine by exercise, which must be carefully regulated to prevent fatigue. 4. To restore the spine to its normal direction by posture, and by pressure applied in the horizontal position.

On mechanical support.

Mechanical contrivances have been much vaunted, and are much employed. I confess, however, to having little faith in their value as *curative agents*. They tend to cause atrophy of the muscles that support the back, instead of strengthening them, and thus to make the deformity a permanent one. In bad and exceptional cases they may be employed when the treatment that has been sketched out cannot be borne or is inapplicable. The general supports, as made by Bigg, Millikin, and others, are then of use. When the deformity is irremediable and support is essential to allow the patient to get about, such instruments are of value; but as curative agents no apparatus is to be recommended.

Should the curvature have been encouraged by any faulty habit, such as standing on one leg, or in one position, or the use of one arm, it is needless to say that the habit should be discontinued.

It is probable that the deformity is greatly due to a compressed condition of the intervertebral substance, it being well-known that this material is capable of being compressed one fourth of its thickness; thus a man by maintaining the erect posture during the day, will be an inch shorter at night than when he rose in the morning. When unequal compression is, therefore, kept up, the deformity produced by it becomes permanent, and the growing bones necessarily assume shapes and positions corresponding to the deformity, and tending to increase it.

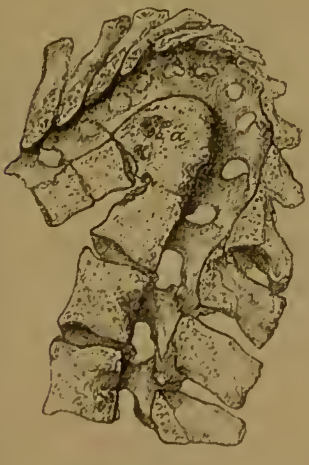
Angular Curvature of the Spine.

Angular curvature.

Pathology.

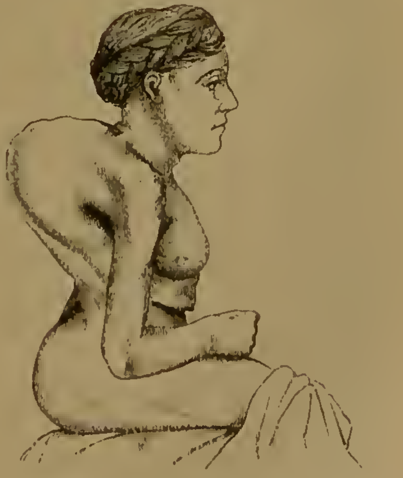
This, which is generally known as Pott's curvature, is due to a destructive inflammatory change of the bodies of the vertebræ and intervertebral substances. It usually begins in the latter structure, although the bone itself may be its primary seat. It is at times associated with tubercular deposit in the tissue, but there is no evidence to prove that it is always due to the presence of tubercle. The curvature is directly due to the destruction of the bodies of the vertebræ and the intervening intervertebral substance, the upper vertebra falling down towards the lower, and joining with it. When the bodies of many of the vertebræ are involved the deformity will be severe; a preparation in Guy's Museum (1006^{50}, Fig. 73), in which the bodies of twelve vertebræ were implicated, shows this, but a cure resulted. Spinal paralysis may attend this affection, although it is rare to find the

FIG. 73.



Angular curvature of the spine.

FIG. 74.



Angular curvature of the spine, the same as that illustrated in the former figure, taken from a patient æt. 35.

cord involved in the disease; the most destructive changes taking place in the bones and great deformity, even to an acute bending of the cord, without giving rise to such complication (Fig. 74); the paralysis may be lasting, but more commonly it is only temporary. Angular curvature may occur at any period of life, but it is more prone to appear during the growth and development of the spine; and is, consequently, more frequently found in childhood. From a remarkable preparation in the Guy's Hosp. Mus. (1004^{92}), it would seem that it may attack the fœtus in utero, the bodies of three or four of the dorsal vertebræ in this case being clearly fused together from disease, giving rise to angular curvature.

Termination in anchylosis.

When a cure takes place it is generally by anchylosis; but occasionally the parts are held together simply by fibrous tissue.

Situation of the disease.

Spinal abscess.

Psoas abscess.

Lumbar abscess.

Gluteal abscess.

The disease more commonly attacks the lower dorsal region of the spine than any other, although the cervical and lumbar regions are not seldom implicated. In rare cases it attacks two different regions of the spine. It may run through its whole course, even to a cure, without giving rise to any external suppuration; more commonly, however, an abscess makes its appearance. *Spinal abscess.*—Pus will sometimes find its way from the dorsal region beneath the fascia that covers in the psoas muscle under Poupart's ligament, and appear as a swelling in the groin at its inner half (*psoas abscess*). The swelling may burrow downwards, and involve the whole thigh in one large abscess. When the disease is in the lumbar region pus may burrow between the dense layers of fascia and tendon that bind in the quadratus lumborum muscle, and appear in the front of the abdomen, above Poupart's ligament, or in the loin (*lumbar abscess*). In other cases it will make its way under the fascia that covers in the iliacus muscle, and appear beneath Poupart's ligament, but at its outer half. In other instances, again, the matter will find a passage downwards into the pelvis, and either make its way through the sciatic notch into the gluteal region (*gluteal abscess*), or pass downwards behind the trochanter major to the thigh. In still rarer cases the pus appears by the side of the rectum.

Pharyngeal abscess.

When the cervical region is the seat of the disease suppuration may appear in the pharynx as a *pharyngeal abscess*, or externally in the neck behind the sterno-cleido-mastoid muscle. The following case is a good example of this:

Examples.

A boy, æt. 3, was brought to me at Guy's, in 1862, for some affection of his upper cervical vertebræ, consequent on a fall downstairs upon his head. An abscess formed, two months after the accident, behind the left sterno-cleido-mastoid muscle, from which place a piece of the lamina of a vertebra escaped six months afterwards. He kept his bed for upwards of one year, when he got up with a stiff neck; he was unable to nod or rotate the head, clearly showing that the joints between the occipital bone and the first two vertebræ had been diseased and become anchylosed. In 1867 this boy came under my notice again. His head was quite fixed; the cervical vertebræ seemed shorter than usual, but no irregularity existed.

The annexed drawings, taken from Ellen T—, æt. 14, a patient of Mr. Poland's, illustrate a severe case of cervical disease with lateral deformity. In this patient a good result was obtained by means of the apparatus depicted in Fig. 77, the cure resulting in anchylosis. Suppuration, however, does not always take place. A woman, æt. 30, came under my care in 1859 for a stiffness of her head and neck, that had been increasing for two years; she had looked upon it as rheumatic. When I saw her the head was immovably fixed, and slightly rotated to the right side. Rotation and nodding were impossible. There was much thickening about the cervical vertebræ; pains darted upwards to the vertex and downwards to the shoulder. By rest in bed, fomentations, and tonics, all these pains disappeared, and recovery ensued, but with a stiff neck.

FIG. 75.

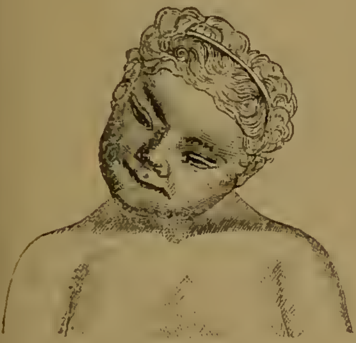


FIG. 76.

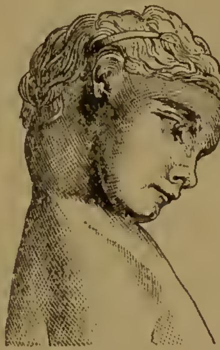
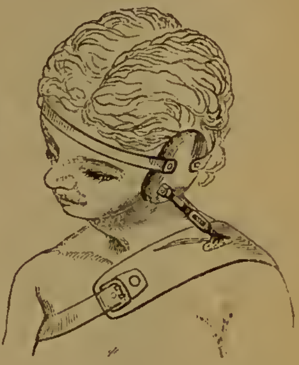


FIG. 77.



Exfoliation of bone.

From any of these abscesses bone may exfoliate; it may be coughed up from the pharynx, or exfoliate from the neck. I have seen a mass of bone, the size of a nut, come away from a lumbar abscess, and a piece of bone, clearly spinal, discharged from an abscess of the thigh, opening above the knee-joint. In a case brought under my notice by a valued dresser, Mr. Burgess, the anterior half of the atlas, with its articular facets, was expectorated, a recovery ensuing; and in the Guy's Hosp. Museum there is a preparation of the odontoid process similarly got rid of. In fact, from all these *spinal abscesses* bone may be discharged, and, what is more, recovery take place.

Diagnosis.

Diagnosis.—When any acute angular cuvature of the spine exists there can be no difficulty in recognising the nature of the disease, or the process by which the curvature has been brought about. When a large abscess coexists with the deformity there is good reason to suspect that the one is the direct result of the other, more particularly when the suppuration can be traced up to the spinal deformity. The difficulty of diagnosis is felt in the early stage of the disease, before any local change has taken place, and it is here that great care is needed, for if any decided good is to be gained by treatment it is at this early period. What, then, are the indications which denote the presence of spinal disease? *Local and persistent pain* is probably the earliest, and when this is accompanied by *local tenderness* on firm pressure the Surgeon's suspicions should be excited. When with these symptoms the patient exhibits a *rigidity of the spine* in walking or moving, when, on being told to pick up anything from the ground, *he bends his knees in preference to bending his back*, the diagnosis becomes more certain. When pain is detected in the course of any of the nerves coming from the seat of the affection; when the patient com-

Difficult in early stage.

Mode of detection.

plains of any sudden jar of the back by a slip down stairs or by any jump; when any constitutional disturbance is present, such as a quick pulse, occasional febrility, and a furred tongue; when all these symptoms, or many in combination exist during that period of life when bones are growing, and bone disease is prone to appear, the Surgeon should always suspect disease of some portion of the spine, and until he can satisfy himself that none such exists, it is a wise plan to treat the case as if it were present. It is true that, by adopting this rule of practice, he will be occasionally misled. He will at times treat a case of hysteria as one of spinal disease; but what harm? He will probably do good to the hysterical patient by the treatment he would adopt for the spinal complaint, while he would certainly do much harm to the latter by neglecting such measures as are essential for its successful treatment.

May simulate hysteria.

Treatment.

Treatment.—It is an interesting clinical fact that the best cases of recovery from the worst examples of spinal curvature and disease are to be found amongst that miserable class of patients who have never had any chance of receiving proper treatment; who have never had rest or any care; in whom the disease has run its course untended and uncared for, and yet in whom a cure has taken place with firm anchylosis, although with deformity. The majority of these cases are examples of disease of the dorsal vertebræ. How far this deformity might have been lessened or prevented by proper treatment is an open question. Nevertheless it is beyond all doubt, that in the early stage of this disease, rest in the horizontal posture, rigidly and persistently maintained, is an absolutely essential point of practice to be observed. Not, however, rest upon the back, for in many instances this supine position tends rather to separate parts that ought to be kept in contact; but rest in any position that the patient feels to be most comfortable. Sometimes the prone position is the best, particularly in young children.

Rest in horizontal position.

The general health of the patient must be maintained as well as possible, by simple nutritious food, stimulants enough to assist digestion, but no more, and tonics, such as iron, quinine, and cod-liver oil.

When pain exists, local fomentations are often a comfort; occasionally the application of a few leeches relieves. Small flying blisters, placed alternately on either side of the painful spot, are sometimes of use, and a plaster of belladonna or opium, rubbed down with glycerine over the part, is a valuable adjunct. When severe nerve pain is present, the hypodermic injection of morphia may be used. Sedatives must be given to procure sleep when it cannot otherwise be obtained. Setons, moxas, and mercury are not to be recommended.

Setons condemned.

By the adoption of this line of treatment a cure may be obtained. It must, however, be followed out for many months, even for years; the greatest care being taken that the patient does not get up too soon, for a relapse is always a very serious affair. Rest had better be maintained too long than given up too soon.

When apparatus to be worn.

When the patient does get up, it is essential that an apparatus should be worn to support the trunk. It must rest upon the hips, and the weight of the upper extremities must be supported by it. It must also be a firm and steady support to the deformed and weakened spine. This is the best carried out by a leathern mould framed on a cast of the back, and adapted to the pelvic crutch and spinal supports. Such an apparatus is made by Millikin, of St. Thomas's Street. I know of no spinal support equal to this in efficiency and comfort. When the disease is in the cervical region, a collar to support the head should be worn for some months after the supposed cure.

Treatment of spinal abscesses.

Spinal abscesses should not be opened hastily, for they may be absorbed and wither away. When steadily progressing, however, they must be treated, and Lister's method is without doubt the best; a free opening should be made under a piece of lint saturated with oil carbolised or not. I have, however, in some cases made a free opening into the abscess without any such precautions, and with an equally good result—making it so free that no pus could be retained, and if air got in it got out again as freely. Retained pus and air are sure to decompose, but if a free vent be made for both, harm rarely ensues. To allow abscesses to enlarge to any extent without interfering is not good surgery, for the amount of constitutional disturbance that follows the opening of an abscess is closely proportioned to its size, and a large abscess cavity secretes more pus than a small one. It is true that after the opening of a chronic abscess, a patient who may have been fairly well, becomes feverish and possibly exhausted by hectic; but it is to be remembered that by delay the abscess will become larger and the constitutional disturbance as a consequence more severe when the opening has taken place.

Disease of cervical vertebræ.

Disease of the upper cervical vertebræ.—Disease of the upper two cervical vertebræ and of the occipital articulation is often found; it may be accounted for by the greater mobility of the joints, and consequent liability of the ligaments to sprain and laceration. Disease may be situated in the bones entering into the formation of the joints, or in the soft parts binding them together; and with the disease some displacement of one of the vertebræ is occasionally met with. When the disease is in the second vertebra, the odontoid process may separate and even exfoliate. Such a result took place in a case illustrated in Guy's Museum, prep. 1018^{15}, in which a woman who had had a stiff neck for months coughed up the necrosed odontoid process; recovery took place with a stiff neck, and four years subsequently the woman was following the occupation of a barmaid.

Exfoliation of odontoid process.

Giving way of the transverse ligament.

When the transverse ligament is diseased the odontoid process may become displaced and the cord injured (Guy's Museum, prep. 1289^{32}). When the displacement is great, under these circumstances sudden death may take place; and when partial, more or less paralysis may ensue, this symptom depending upon the amount of pressure the cord has sustained. Fixed pain about the cervical vertebræ, with stiff neck, is always suspicious of cervical disease; and when aggravated by rotation or downward pressure of the head the case is a serious one. Under these circumstances the aspect of the patient is very characteristic; the chin is tilted up, and all the muscles of the neck are rigid; the patient may even support the head with his hands.

Treatment.

TREATMENT must be conducted on recognised principles. The danger of a sudden death by the displacement of the bones must be diminished by the application of a support to keep the head straight and prevent its falling forwards. This is well done by the application of a collar round the neck, passing under the chin with a support embracing the head. Rest in the horizontal position is of great value, as also are other remedies similar to those that have been mentioned in the treatment of angular curvature of the spine. In cases of severe spinal curvature there is good reason to believe that the span of life is often shortened, on account of the interference with the respiratory and circulatory functions caused by the deformity. My colleague Dr. Fagge has written an interesting paper on this point. ('Guy's Hosp. Rep.,' 1874.)

INJURIES AND DISEASES OF THE NERVES.

Contusions.

When a nerve is struck or contused, pain is produced; it may be of a passing tingling character, or of a far more severe kind. Most people are rendered familiar with these facts by an occasional blow upon the ulnar nerve, or what is called the "funny bone." When the blow has been severe the pain may be lasting, and the functions of the nerve so disturbed or interfered with as to give rise to loss of power or sensation in the parts supplied by the injured nerve. A man, æt. 29, went to sleep with his elbow resting on a table, and when he awoke there was complete paralysis of the parts supplied by the ulnar nerve, and loss of sensation. When I saw him two days afterwards these symptoms were very marked; there was also tenderness over the nerve behind the inner condyle; to which spot a blister was applied. In two weeks returning sensation appeared, with some slight power of motion; in five weeks he was well. This was clearly a case of paralysis of a nerve from a contusion. A man, æt. 46, received a blow upon his ulnar nerve against a chair. No pain appeared at the time, but three hours later pain and numbness showed themselves, and at this time some thickening over the spot could be made out. In the course of three weeks these symptoms disappeared and recovery was complete. In this case it would appear as if some hæmorrhage had taken place into the nerve sheath, giving rise to the paralysis, which disappeared as the blood was absorbed.

Examples.

Wounds of Nerves.

Wounded nerve.

When a nerve is *wounded*, pain is produced. This may be of a passing character or more permanent; in nervous, hysterical subjects the nerve pain is sometimes severe and persistent—it is then called neuralgia. It may be confined to the injured branch of a nerve, or reflected to and back from the spine and involve the whole trunk.

Divided nerve.

When a nerve is *divided*, complete paralysis of the part supplied by it results; it may, however, reunite and recovery take place. Paget, in his 'Lectures on Surgical Pathology,' 3rd ed., has related a case of complete division of the median nerve, in which the trunk had nearly recovered its conducting power a month after the wound. I have seen a like case in which recovery ensued in four months. The following example is another case in point.

Example.

A woman, æt. 30, came to me with an incised wound behind the inner condyle of the humerus. The ulnar nerve had been completely divided, and there was perfect paralysis of motion and sensation of the parts supplied by it. The edges of the wound were adjusted and the arm was placed in a sling. A month later she came again with a burning pain in the little finger, which was really cold, but red, swollen, shining and blistered; and when touched some slight sensation was produced. Cotton wool and oiled lint were applied, and the arm was fixed upon a straight splint. The original wound had nearly healed. In two weeks the finger looked natural; sensation in it and all other parts supplied by the nerve had improved. In another month she returned with the old symptoms as bad as ever; they had reappeared upon the removal of the splint two weeks previously; on its reapplication with the cotton wool they again disappeared. The splint was then kept on for two months, when sensation became natural, complete repair having taken place in four months. When seen six months later she was still well.

Characteristics.

The red, swollen, shining, and blistered condition of a finger deprived of nerve force is characteristic; it is generally associated with the sensation of a burning pain and loss of temperature, amounting sometimes to a depression of 9° or 10° Fahr. These symptoms are clearly due to malnutrition. When the nerve repair does not take place, these symptoms are very prone to return from time to time on any change of temperature or depression of the general power of the patient. When the ulnar nerve is completely paralysed, in which case atrophy of the muscles supplied by it ensues, the aspect of the hand is very characteristic, the wasting of the interosseous muscles, with the abductor indicis (also an interosseous), and all those of the little finger, giving rise to a peculiar hollowing of the parts between the metacarpal bones which is typical. Nerves, when divided, do not, however, always reunite. When a piece has been removed, either by accident or by design, as in the operation for tic douloureux, the restoration of function is very rare, although it may occur.

Treatment.

Treatment.—Bruised nerves are to be left alone, natural processes being, as a rule, amply sufficient to effect a cure. When recovery is slow, and associated with pain in the injured part, the application of a small blister is beneficial. When a nerve is divided it is well to put the divided ends as closely in contact as can be done; to place the limb in such a position as will prevent any separation of the divided portion; to keep the paralysed parts warm with cotton wool and of an equable temperature, and the whole limb at rest until complete repair has taken place. The application of a suture to a divided nerve is a legitimate proceeding; it is not, however, uniformly successful. When much nerve pain exists belladonna or opium rubbed down with glycerine is a nice application, or the hypodermic injection of morphia.

Neuralgia, tic douloureux.

Neuralgia.

The subject of neuralgia belongs more properly to the physician than the Surgeon, but the latter is often called upon to consider cases of this nature. The first point is to determine whether the pain is due to any local cause, and, if so, to remove it. Thus, a decayed tooth is too often the cause of pain in the course of branches of the fifth nerve, although the tooth may have neither ached nor exhibited any external evidence of decay. The pressure of a small tumour on a nerve, some irregularity in the bone, or a cicatrix involving a nerve, are causes which sometimes require the interference of the Surgeon to effect a cure. The following example illustrates these remarks:

Local cause.

Example.

A man, æt. 41, came under my care in 1866, for severe pain down the anterior and outer portion of his left leg and foot, with almost complete paralysis of the extensor muscles. The symptoms had been coming on gradually for years, and had followed a severe wound sustained twelve years previously over the head of the fibula. There was a hard cicatrix over the head of the fibula, which clearly involved the external popliteal nerve. I made two deep vertical incisions on either side of the cicatrix, in this way taking tension off the nerve, and affording complete relief; six weeks later he was still well. Whenever neuralgic pain is associated with a cancerous tumour, or comes on after its removal, the Surgeon should suspect the existence of some secondary cancerous deposit in the course of the sensory nerve.

The great majority of cases, however, of neuralgia has a constitutional origin, and the cause is to be found in some hereditary tendency, in impaired health, depression, anxiety, or some obvious derangement such as is expressed by the term anæmia. Many cases, too, have a malarious origin, and depend on climatic influences, such as residence in a damp or wet place. Cases of neuralgia are of frequent occurrence, and represent what would have been formerly ague, showing the influence of the miasmatic air. The disease known as "tic douloureux" is an affection of the fifth nerve and its branches, but any nerve in the body is liable to suffer. The pain is often very intense, and recurs in paroxysms at certain hours or on exposure to draught or cold.

Treatment.
Local.

TREATMENT.—The treatment of these cases of neuralgia must be regulated entirely by their cause. When a local cause can be made out, its removal is the only correct plan—for example, the removal of a tooth, of a tumour, or of a bulbous extremity of a nerve. When hysteria complicates the case, or any uterine disturbance, tonics are suggested, such as iron, zinc, or quinine, and of these full doses may be given. When malaria appears to be the cause, bark or quinine is invaluable. In local neuralgia, more particularly in *sciatica*, the hypodermic injection of morphia in one-third or half-grain doses often acts as a charm. The fluid should be injected in the course of the nerve, and in all forms of neuralgia it is of value. Chloroform, belladonna, and opium, locally applied, are also of use. The general condition of the patient should always be looked to, and the treatment directed to its improvement. Good food, good air, and tonics, are always essentials. Purgatives are seldom needed, and must be regulated so as not to depress. Stimulants are of great use, but not in excess. In females the condition of the uterine organs should always be carefully attended to.

General.

Division of nerve.

In obstinate cases of neuralgia the division of the nerve has been performed with occasional success; it is not, however, an operation for which much can be said in its favour. When the cause of the neuralgia is peripheral it may succeed for a time, but in these cases spontaneous recovery is not unusual; and when some central mischief is the source of the pain the operation is not likely to be of use. Nevertheless, in desperate cases the excision of a portion of the offending nerve is a justifiable operation; it has been of use and may be so again. Dr. Fayrer has related in the 'Medical Times' for 1868, a case of sciatica in a syphilitic man, æt. 30, in whom swelling was detected in the nerve sheath, and pain was at once relieved by puncturing the part with a knife.

Neuroma.

Neuroma.
Pathology.

Any tumour connected with a nerve is called a neuroma. These neuromata may be of a fibrous or of a fibro-cellular kind, and there is reason to believe that they may have an inflammatory origin. They may be very small, or of large dimensions, and when large they may contain cysts. Sometimes they are developed within the nerve sheath; at others they are situated upon it. In a third class the fibrillæ of the nerve trunk appear to be separated by the new tissue, or to be incorporated with the growth. They are at times single, but more frequently multiple; occasionally they involve nearly every cerebro-spinal nerve in the body. Wilks has recorded such a case in the 'Path. Soc. Trans.,' vol. x, in which after death neuromata were found all over the body, appearing as nodules on some nerves, as distinct tumours on others, the nerves appearing of irregular size and indurated in a third, the fibre tissue being infiltrated among the nerve fibres. The pneumogastric nerve had a tumour the size of an egg upon it. Dr. Smith, of Dublin, in his unrivalled monograph upon the subject, has recorded an instance in which many hundreds of such tumours existed, and others might be quoted.

Symptoms.

These tumours are not, as a rule, painful; indeed, in the most marked examples of this disease, in which the tumours are multiple, they are often not recognised till after death. Pain is, however, sometimes present, aggravated on pressure, and apparently depending much upon the mode in which the nerve is involved. This affection is not to be confounded with the *painful subcutaneous tumour.* When the ends of a divided nerve become enlarged from fibrinous effusion, and consequently bulbous, what is called a *traumatic neuroma* is formed. When this becomes involved in the cicatrix of a stump it is an exceedingly painful affection; it is thought by some Surgeons to be more common after flap amputations than others; it must be remembered, however, that all nerve trunks become more or less bulbous after amputation.

Treatment.

TREATMENT.—There is no reason why neuromata should be removed or touched, unless they are very large or very painful. When from these causes they require treatment, the operation should be performed, care being observed to dissect the tumour from the nerve, when it is possible; this, however, can rarely be done. Many cases are on record in which large neuromata have been excised with the nerve trunk, and a good recovery has ensued, even with a restoration of the functions of the divided nerve. Traumatic neuromata should always be excised when causing much pain, but when associated with symptoms of spinal irritation, which may possibly be caused by a neuritis travelling up the affected nerve trunk, the forcible stretching of the bulbous nerve as practised by Billroth and Nussbaum deserves a trial.

Painful subcutaneous tumours.

Painful subcutaneous tumours.

These tumours are clinically to be separated from the neuromata which have just been considered, although they have doubtless often been confused with them. They are not, however, nerve tumours, although *intense painfulness* is their clinical peculiarity. They were first described by Wood, in the 'Edinburgh Medical Journal' for 1812. They are usually single and situated in the subcutaneous tissue; they are rarely larger than a small bean. They are encysted, and give to the finger a hard elastic touch. To the eye they appear bright yellowish or of a pearly white. They appear to be made up of fibro-cellular or fibrous tissue. They have no such nerve connection as will explain their excessive sensibility. The pain, says Paget, is of the nature of that morbid state of nerve force which we call neuralgia.

Structure.

The painful character of these tumours is very peculiar; it is not constant, nor does it appear to depend upon any injury; it sometimes comes on without any assignable cause or after only the slightest touch, the pain beginning in the tumour, gradually increasing in intensity and extent till it becomes almost unendurable, darting from the tumour up and down the limb or over the body. The muscles of the limb may likewise be spasmodically affected. The paroxysm may last only a few minutes, or continue for hours; it subsides as it appears, gradually, leaving the parts that were the seat of pain tender. These painful tumours are most frequent in the female, the neuromata in the male.

Excision.

TREATMENT.—The only treatment is the excision of the growth, and it is generally effectual. These tumours rarely recur, although Paget has recorded one or two examples in which a return took place.

CHAPTER VIII.[1]

DISEASES AND INJURIES OF THE EYE, &c.

EXAMINATION OF THE EYEBALL AND ITS APPENDAGES.

The examination of the eyeball will be considered under four heads:—

1st. By the unaided eye.
2nd. By means of lateral illumination.
3rd. By the ophthalmoscope,
  (*a*) Direct examination.
  (*b*) Indirect examination.
4th. By manipulation.

The *refraction* of the eyeball, the field of vision, &c., will also receive a short notice.

I. Examination by the unaided Eye.

Examination by unaided eye.

In order to examine the outer surface of the eyelids, ocular conjunctiva, cornea, anterior portion of sclerotic, aqueous chamber, and lachrymal apparatus, it is necessary to place the patient in a good light (as before a window), and direct him at first to close the eyes, then open them widely, and look by turns in different directions.

How to evert upper lid.

To examine the palpebral conjunctiva it is necessary to evert the upper lid, and to draw the lower one downwards. Eversion of the upper lid can be accomplished thus:—The Surgeon, standing in front of the patient, should direct him to look downwards and close the eyes; he should then place the forefinger of one hand upon the lid at the attached border of the tarsal cartilage, and make gentle pressure downwards and backwards, so as to cause the free edge of the lid to stand away from the eyeball; then place his thumb beneath the margin of the lid, and make a slight upward movement, at the same time continuing the pressure with the finger; by this means the lid will be made to turn upon itself and become everted; or the lid may be everted by pressing a probe horizontally upon its outer surface, and drawing it upwards by means of the lashes, at the same time making pressure downwards with the probe.

To examine the conjunctiva covering the lower lid, all that is necessary is to place the finger upon the margin of the lid and draw it strongly downwards, when its conjunctival surface will be exposed.

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[1] In the preparation of this chapter I have had the kind assistance of my friend and colleague Mr. Charles Higgens.

Normal Appearances.

Normal appearance of eyelids.

The outer surface of the eyelids is covered by soft, delicate skin, which is thrown into folds on every action of the orbicularis; their free margins are of some thickness. From the outer edge of this free margin project the lashes in two or three rows, those of the upper lid being thicker and longer than those of the lower. The lashes extend along the whole outer edge of each lid, but are much fewer and more delicate in that portion extending from the tear punctum to the inner canthus.

Of conjunctiva. Ocular.

The inner edge of each margin is occupied by the orifices of the Meibomian glands, which are seen as a close set of yellowish points. *The ocular conjunctiva* is smooth, moist, shining, and transparent, allowing the white sclerotic to show plainly through it; a few vessels are generally seen running from the outer and inner canthi towards the cornea, but these are perfectly consistent with a healthy condition of the membrane. The caruncle and semilunar fold occupy the space immediately external to the inner canthus, the former appearing as a small reddish-grey projection, the latter as a well-defined pinkish fold. *The palpebral conjunctiva* is also smooth, moist, shining, and transparent, and appears to have somewhat of a yellowish colour from the tarsal cartilage, to which it is closely and evenly united, showing through it. The portion of membrane reflected from the lids to the globe (*fornix*) appears somewhat thickened and wrinkled, and is slightly more vascular than the ocular and palpebral portions.

Palpebral. Fornix.

Parts requiring special notice.

Certain parts of the conjunctiva require to be specially examined. The portions next the thickened margin of the lid, in the fornix, and about the caruncle, are the most likely situations for the lodgment of a foreign body. That portion covering the attached border of the tarsal cartilage also should be noticed, as it is here that granular ophthalmia manifests itself more plainly.

Cornea.

The cornea is smooth, shining, and perfectly transparent throughout, except in the case of old people, in whom a bluish-white rim (arcus senilis) is often seen occupying more or less of the corneal margin; no blood-vessels are seen on its surface or in its substance.

Sclerotic.

The anterior portion of the sclerotic is pearly white, or of a pale bluish tint, and shining. It is plainly visible through the transparent conjunctiva covering it; some fine vascular twigs may occasionally be seen traversing it in front of its equatorial region. The aqueous chamber is filled by the aqueous humour, which is transparent, colourless, and of such a quantity as to preserve the proper curvature of the cornea without causing tension, or allowing of laxity, and to keep it separated from the iris by a considerable interval.

Iris.

The iris varies in colour in different individuals; it is bright and smooth, presenting in health no appearance of blood-vessels. Its plane is exactly vertical; the pupil, situated somewhat to the inner side of the centre of the iris, is perfectly circular, and dilates and contracts quickly with variations of light.

Lachrymal apparatus.

The examination of the *lachrymal apparatus* gives chiefly negative results; the position of the tear puncta closely in contact with the ocular conjunctiva must be noticed; pressure with the finger over the lachrymal sac causes no escape of fluid through the puncta, neither can the lachrymal gland be felt or seen in a normal condition of the parts.

II. Examination by Lateral Illumination.

Examination by lateral illumination.

By this method all the parts mentioned above are seen more clearly. Minute foreign bodies, slight opacities of the cornea, &c., which might be overlooked in examining with the unaided eye, are discovered, and in addition the whole of the lens and the anterior portion of the vitreous can most satisfactorily be looked into.

The method of examination should be as follows:—The patient should be seated in a dark room (the pupil being previously dilated with atropine), and a lamp placed at about two feet distance on the left, and rather in front of his face. The Surgeon should stand nearly in front, or rather to the patient's right side, and facing him; he should then take in his right hand a bi-convex lens of about two and a half inches' focal length, and with it concentrate the light on the surface of the cornea; with a little manœuvring he will find that he can throw the light through the pupil to a considerable depth into the eye. The patient should be told to look in various directions, so that all parts of the anterior portion of the eye may be examined.

Appearances of lens.

The results obtained by lateral illumination are chiefly negative. The lens in health is perfectly transparent, and in youth is nearly colourless, but some bluish lines showing its division into different segments can be recognised by careful examination. As age advances, these lines become more marked, and the whole lens appears of a bluish-grey colour, though its transparency is still unaffected.

Behind the lens all appears dark, but any tumour, hæmorrhage, &c., occupying the anterior part of the vitreous would be discovered.

It should be noticed in the examination by lateral illumination that opacities of the cornea, &c., always appear with greatest distinctness on the side which is farthest from the light. A second lens may also be used to magnify the parts illuminated by means of the first.

III. Examination by the Ophthalmoscope.

Ophthalmoscope.

Description of the instrument.—The ophthalmoscope, as used at the present day, consists essentially of a mirror of silvered glass or polished metal, having a central opening, with certain accessory portions in the shape of convex lenses of different foci, used as objective lenses; clips and other contrivances for holding ocular lenses behind the sight hole of the ophthalmoscope, together with the ocular lenses themselves. The ophthalmoscope since its introduction has undergone innumerable modifications, both in principle and detail; the number of different instruments now in use being nearly, or quite, as great as that of ophthalmic Surgeons.

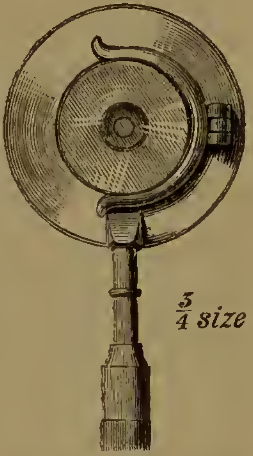
Liebreich's.

The most useful form of ophthalmoscope is that of Liebreich's; the latest modification (Fig. 78) of this instrument consists of a silvered glass mirror of about eight inches' focal length, having a central opening in the silvering of a line and a half diameter. The mirror is fixed in a metal back, having a central perforation about double the diameter of the opening in the silvering. Upon the metal back is fixed a clip for the purpose of holding an ocular lens; the back is screwed to a handle about two and a quarter inches long. The accessory portions consist of two object lenses of two and a half and three inches' focal length respectively, and five ocular lenses—two convex, of six and twelve inches positive foci; three concave, of eight, twelve, and twenty-four inches negative foci; all are made to fit into the above-mentioned clip. A very convenient case contains the whole.

Method of using the ophthalmoscope.—There are two methods of using this instrument. The first, which requires much practice, is called the direct method of examination, or examination of the *erect image*, with the ophthalmoscope alone, without the aid of a bi-convex object lens.

The second, which is much the easier of the two, is called the indirect method, or examination of *the inverted image;* in it both the ophthalmoscope and a bi-convex lens are used.

FIG. 78.



Liebreich's ophthalmoscope.

Examination of erect image.

Direct ophthalmoscopic examination.—In this method a virtual erect image situated behind the eye is seen. The examination is conducted in the following manner:

The patient being seated in a dark room, a gas or other lamp (gas being preferable) should be placed at the side corresponding to the examined eye, on a level with it, but so situated as to leave the cornea in shade; he should then be directed to look forwards and a little upwards, at some distant object, and to keep the eyes as steady as possible.

Position of lamp.

Supposing the right eye to be examined, the lamp should be placed at the patient's right side; the observer, standing in front at a distance of eighteen inches or two feet, should take the ophthalmoscope in his right hand, look through the sight hole with the right eye, and reflect the light from the lamp through the pupil of the patient's right eye. If the examination be conducted properly, the pupil will appear of a bright red colour. The observer should then look for the optic disc, which is situated rather to the inner side of the axis of the eyeball; he will know that the disc is in view from the alteration in colour of the pupil, which will turn from red to white, or pinkish white. Having obtained the peculiar reflection of the optic disc, the observer (taking care to relax his own accommodation) should approach the eye until an interval of only two inches separates his cornea from that of the examined eye. Some difficulty will be experienced in keeping the eye illuminated, especially as the distance between the observed and the observer becomes less; this, however, will be overcome by practice. When the observed eye has been approached to within a distance of two to three inches (supposing both the examining and examined eye to be emmetropic), a distinct erect and considerably magnified image of the parts occupying the fundus of the latter should be obtained; but most observers will find the image considerably sharpened in outline and detail by using a weak *concave* lens behind the sight hole of the ophthalmoscope. If either the observer or patient be myopic, it will be found necessary, in order to examine the erect image, to place a concave lens, which rather more than neutralizes the existing ametropia, behind the sight hole of the ophthalmoscope.

Use of concave lens.

The examination of the erect image, although requiring much more practice than that of the inverted, should never be neglected, as it gives much more satisfactory evidence of minute changes in the fundus oculi, all the parts being seen highly magnified (about 14½ times). It gives, however, a less extensive field of vision, on account of the size of the objects, which only allows small portions of them to be seen through the pupil at one time.

Size of image.

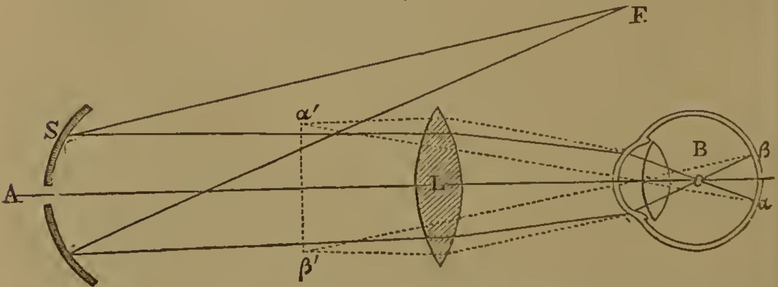
The optic disc, retinal vessels, and other parts occupying the fundus, should be examined by looking in different directions through the pupil; the observed eye being kept steadily fixed during the examination upon some distant and suitably situated object.

The right eye having been examined, the lamp should be placed on the patient's left side, and the manœuvre repeated; the observer using the left hand and left eye, instead of the right hand and right eye. The condition of refraction of the eye can be diagnosed by the direct method of examination.

Inverted image.

Indirect ophthalmoscopic examination.—In this method of examination an inverted aerial image of the fundus oculi is formed by the interposition of a biconvex lens between the observer and observed eye. (*See* Fig. 79.)

Fig. 79.



From Carter's translation of 'Zander on the Ophthalmoscope.' A, Observer's, B, observed eye. F, The light. S, The mirror. L, The biconvex lens. α β, Some portion of the retina, or the disc. α′ β′, Its inverted aerial image formed between the mirror and biconvex lens.

Method of examination.

The position of the patient and observer should be the same as for the direct examination; the same lamp also can be used, but should be placed rather further back and kept on the patient's left side during the examination of either eye. The ophthalmoscope should be held in the same manner and the light reflected through the pupil as detailed above; but the red reflection having been obtained, the observer must not approach the eye, but remain at a distance of about eighteen inches.

The patient should be directed to look at some distant object so situated that the axis of the observed eye is turned somewhat inwards; this brings the optic disc (which lies somewhat to the inner side of the optic axis) to stand opposite the ophthalmoscope, and its peculiar bright reflection will be at once observed.

The bi-convex lens should then be held in front of the observed eye at a distance about equal to its own focal length from the cornea, and steadied by the observer resting his ring and little fingers on the patient's brow. By this means an inverted image of the optic disc and vessels of the retina is immediately seen, which, although apparently within the eye, is in reality formed in the air between the observer and the bi-convex lens, and (in emmetropia) at a distance from the latter corresponding to its focal length.

Position of image.

If the image of the disc appear indistinct, the observer may be sure that his own eye is not accommodated for the distance at which the image is situated, which is, in reality, shorter by some inches than it appears to be. Should this be the case, the observer must increase the tension of his accommodation, or withdraw somewhat further from the observed eye.

Use of convex ocular lens.

A better method, however, than either of these, is to employ habitually, behind the sight hole of the ophthalmoscope, a convex ocular lens of about ten or twelve inches focal length. If this be done, a clear and well-defined image will always be obtained without tension of accommodation, provided that precautions be taken that the distance between the observer's eye and the image be *not greater than the focal length of the convex ocular lens.*

The disc and parts immediately surrounding having been examined, the patient should be directed to look straight forward, so as to bring the region of the yellow spot opposite the ophthalmoscope; this having been carefully examined, the eye should be turned upwards, downwards, to the right and left, so that all parts of the fundus may be examined in turn.

In the indirect method of examination the observer should use his right eye, and hold the ophthalmoscope in his right hand and the biconvex lens in his left in examination of the right eye, and *vice versâ* in examination of the left.

Difficulties of Ophthalmoscopic Examination.

Inconvenience from reflections of mirror.

Considerable practice is required in order to become proficient in the use of the ophthalmoscope; the beginner will be frequently much disheartened at his want of success. Some of the difficulties are only to be overcome by practice, others are easily remedied. Reflections of the mirror from the two surfaces of the object lens often prove very troublesome; the inconvenience arising from this source is obviated by holding the lens somewhat obliquely, when the two images will recede from each other and leave a clear space between them. Reflection from the surface of the cornea is also troublesome, but can usually be overcome by a little manœuvring. Contraction of the pupil is also an insurmountable obstacle to the beginner, but this can be removed by dilatation with atropine; for this purpose a solution of one grain to one ounce of water should be dropped into the eye about half an hour before the examination is made; or the patient may be ordered to use a solution of one eighth grain to one ounce for a day previous to his visit. But when experience has been gained atropine can be dispensed with, except in some cases, or in those where it is necessary to make a careful examination by lateral illumination.

How obviated.

Use of atropine.

It will generally be found that directing the patient to look at a distant object, and so to relax his accommodation, will cause quite sufficient increase in the pupillary area.

Every ophthalmoscopic examination should be conducted on a certain definite system.

Systematic examination.

The first step should be to examine the condition of the refractive media by lateral illumination.

Next, the condition of refraction of the eye should be ascertained by the direct method of examination.

Thirdly, a general survey of the fundus oculi should be made by the indirect method.

And fourthly, any abnormalities having been discovered by the indirect examination should be fully and carefully studied in detail by the direct method.

If this systematic plan of examination be carefully carried out few mistakes will be made, and no abnormality of importance is likely to be overlooked.

Normal appearance of parts seen by the Ophthalmoscope.

Normal appearances.

The refractive media (cornea, aqueous humour, lens, and vitreous), as stated under Lateral Illumination, are perfectly transparent.

Retina.

The retina is transparent, colourless, or in dark eyes may appear as a faintly grey cloud, covering the choroid; its position is marked by that of its blood-vessels. The bright red reflection previously mentioned is due to the blood in the choroid; the colour of the reflection varies with the amount of pigmentation of this vascular tunic—in blue or grey eyes it is bright red, in dark ones of a much deeper tint, and in the negro appears to be dark blue. The parts of the fundus oculi requiring special attention are the optic disc and parts immediately surrounding it, and the region of the yellow spot.

Choroid.

Optic disc.

The disc appears at first sight to be of an uniform pale pink colour, but on closer examination different portions are found to present different shades.

Its centre is pale, or even white; next to this succeeds a zone of pink, this being again bounded by an apparently double border of lighter colour. The pale appearance of the central portion of the disc is caused by connective tissue surrounding the blood-vessels in this situation.

The succeeding pink zone consists entirely of nerve-fibres and delicate capillaries. The outer pale double border is formed by the margins of the sclerotic and choroidal rings, which do not accurately cover each other, the choroidal ring being somewhat greater in diameter than the sclerotic opening, the margin of which, being left uncovered by pigment, shines through the transparent nerve-fibres.

Peculiarities of optic disc.

Both the white central portion and the outer ring are in some cases so distinctly marked that the appearance produced might be taken by an inexperienced observer as evidence of disease, but both conditions are perfectly consistent with health. From the pale central portion of the disc proceed the retinal blood-vessels; these appear upon its surface usually at the same point, but may emerge separately or in groups of two or three.

Retinal vessels.

Usually about eight vessels are seen, four of these being arteries, with a corresponding number of veins; two of each pass upwards and a like number downwards, to be distributed over the retina. The lateral branches are comparatively insignificant, and are given off from the principal trunks, either upon the nerve surface or in the retina near its margin.

Distinction between arteries and veins.

The veins are distinguished from the arteries by being of greater calibre, the proportion being about three to two. There is also a difference in colour between the two, the veins being the darker; the arteries are marked by a double contour, and their central portion is much lighter than their borders.

Occasionally a dark spot is noticed in one of the vessels at its origin or termination in the disc. This might be taken for a clot, but the appearance is caused by a peculiar arrangement of the vessel, which at this point is seen, as it were, on end and foreshortened.

Spontaneous pulsation.

Spontaneous pulsation of some of the retinal *veins* may also be observed; the occurrence of *venous* pulsation is, however, perfectly consistent with health, and has no pathological import.

In any eye, pulsation, both arterial and venous, can be produced by pressure upon the globe, but should it occur spontaneously in the *arteries* has the gravest significance. (*See* Glaucoma.)

Anomalies of Optic Disc, &c., consistent with Health.

Certain phenomena are not unfrequently observed with the ophthalmoscope, which, although contrary to the condition usually met with, are perfectly consistent with a normal state of the parts.

The appearances caused by the connective tissue surrounding the central vessels, the occurrence of pulsation, unusual distribution, and existence of dark spots in the latter, together with the unusual distinctness of the sclerotic ring, have been already mentioned.

Other anomalies are—

Dark crescent.

1. *A dark crescentic* figure bordering some portion of the margin of the disc. This appearance is caused by a peculiar arrangement of the choroidal pigment.

Variations of colour.

2. *Variations in depth of colour of the disc* are frequently met with. Due regard must be had to the colour of the surrounding fundus in forming an opinion as to whether the tint in any particular case is so much deepened or lessened as to constitute a diseased condition.

In light eyes the disc appears much redder than in dark, the apparent difference being due more to contrast with the surrounding parts than to actual change in colour.

Slight deviations are only to be determined by careful examination and long experience.

Excavation of disc.

3. *Excavation of the optic disc.*—Not unfrequently a sloping or even abrupt depression is met with occupying the centre of the disc, but usually extending somewhat further towards the yellow spot than in other directions. The whole nerve surface, however, is never included in the cup; the vessels do not bend under its edge, their calibre is not altered, neither is spontaneous arterial pulsation observed, as may be the case in the excavation of glaucoma. (*See* Glaucoma.)

Hyaloid artery.

4. *Persistence of the hyaloid artery.*—Occasionally a small whitish cord may be seen extending from the centre of the disc to the back of the lens; it is the remains of a vessel which, during fœtal life, nourished the latter structure.

Senile changes.

5. *Senile changes.*—As age advances, the refractive media become less transparent, the retina grows somewhat hazy, and the disc appears whiter than natural.

Opacity of nerve fibres.

6. *An appearance of white wisp-like patches*, extending from some part of the margin of the disc over the surrounding fundus. These

patches have irregular jagged borders, and are often of considerable size; the retinal vessels pass through and are obscured by them.

The patches are caused by the opaque nerve-sheaths which should end at the lamina cribrosa, being accidentally continued beyond this point into the transparent retina; they are congenital, and do not interfere with vision.

Yellow spot. *The region of the yellow spot* presents in health no very marked ophthalmoscopic signs, but requires special notice, as it is frequently the seat of pathological lesions. In the normal condition it is marked by the absence of blood-vessels, which appear to avoid this part of the retina, passing above and below it; there is some deepening in colour, and occasionally an indistinct transversely oval figure can be detected.

IV. Examination by Manipulation.

The fourth method of examination, *by manipulation*, consists simply in ascertaining the tension of the globe by digital pressure. The examination should be conducted as follows:

Tension of globe. The patient being directed to look downwards and close the eye gently, but not to screw up the lids, the Surgeon should make gentle alternate pressure with the forefinger of each hand placed upon the closed upper lid; the pressure should be made in a direction backwards and somewhat downwards, so as to compress the globe against the floor of the orbit.

In health the eyeball is firm, tense, and semi-fluctuating; in disease the tension may deviate in the direction of increase or decrease. The degree of tension may be arbitrarily expressed by nine T's.

If normal, as Tn; if above par, as T + 1, T + 2, T + 3, according to the amount of increase; if below par, as T — 1, T — 2, T — 3. If a doubt exist, as T + ? or T — ?, according as the doubt is on the side of increase or decrease.

REFRACTION, ACCOMMODATION, AND FIELD OF VISION.

Refraction. *Definition.*—By refraction of the eye we understand the power which the refractive media (cornea, humours, and lens) possess by virtue of their curvatures and densities of bringing together *parallel* rays of light, and forming them into an image at a certain spot (known as the principal focus of the refractive or dioptric system), *without the employment of any adjusting power.*

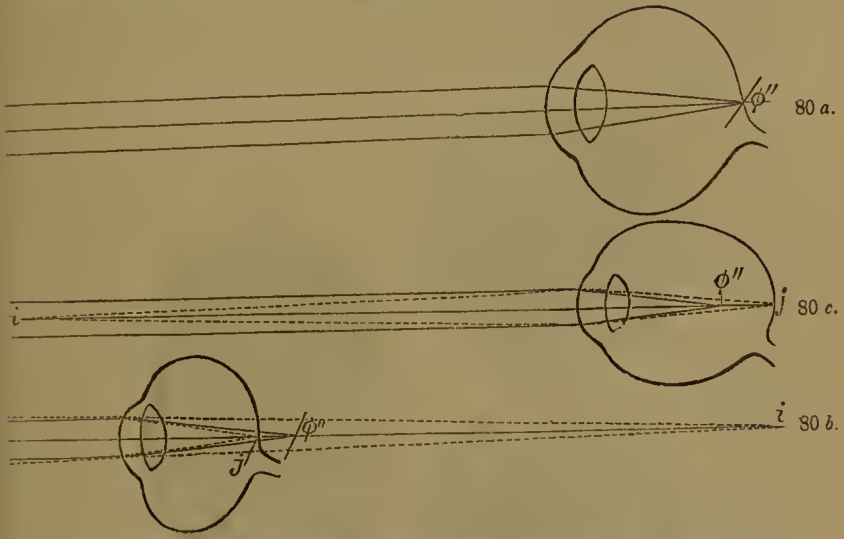
The refraction is said to be *normal* or *abnormal*, according to the position of the retina with regard to the focus of the dioptric system. The former condition is known as *emmetropia*, the latter as *ametropia*, the terms normal and abnormal being seldom applied.

Emmetropia. **Emmetropia.**—The emmetropic eye (Fig. 80 *a*) is of such a shape that the retina is situated at the focus of the *dioptric system*, and in such a position that a distinct and inverted image of any object (*the rays of light proceeding from which are parallel*) is formed upon the layer of rods and cones.

Ametropia. **Ametropia.**—The ametropic eye differs from the emmetropic in two opposite directions; the deviations are known as *anomalies of refraction.* In the first and (in this country) most commonly met with anomaly the retina lies *within* the focus of the dioptric system; that is to say, the axis of the eyeball is too short from before backwards; and images of objects, the rays of light proceeding from which are parallel, are formed behind the retina instead of in its substance. This anomaly is known as hypermetropia, or far sight (*see* Fig. 80 *b*).

Hypermetropia.

FIG. 80.[1]



From Donders, 'Accommodation and Refraction of the Eye.'
a. Emmetropia. *b.* Hypermetropia. *c.* Myopia.

To the second anomaly an opposite state of things pertains; the axis of the eyeball from before backwards is too long, consequently the retina comes to lie outside the focus of the dioptric system, and the image of an object, the rays of light coming from which are parallel, is formed in front of it. This anomaly is known as *myopia*, or short sight (*see* Fig. 80 *c*).

Myopia.

The diagnosis of anomalies of refraction can be made by trial with lenses, or by *direct* ophthalmoscopic examination.

A very useful ophthalmoscope (Fig. 81), by means of which anomalies of refraction can not only be diagnosed, but also accurately measured, has been devised by Mr. Charles J. Oldham, of Brighton (*see* 'Report of Fourth Ophthalmic Congress,' 1872).

Oldham's ophthalmoscope.

The TREATMENT consists mainly in neutralizing the anomaly by suitable spherical lenses.

For further information on the subject of refraction the reader is referred to works treating specially of ophthalmic subjects, more especially to that on 'The Accommodation and Refraction of the Eye' (Donders).

Accommodation.

By accommodation is meant the power which the eye possesses of altering the condition of its refractive media, so as to form upon the retina images of near objects, the rays of light from which are divergent, equally as distinct as images of more distant ones, the rays of light from which are parallel, or nearly so.

Accommodation.

The power of accommodation depends upon the elasticity of the crys-

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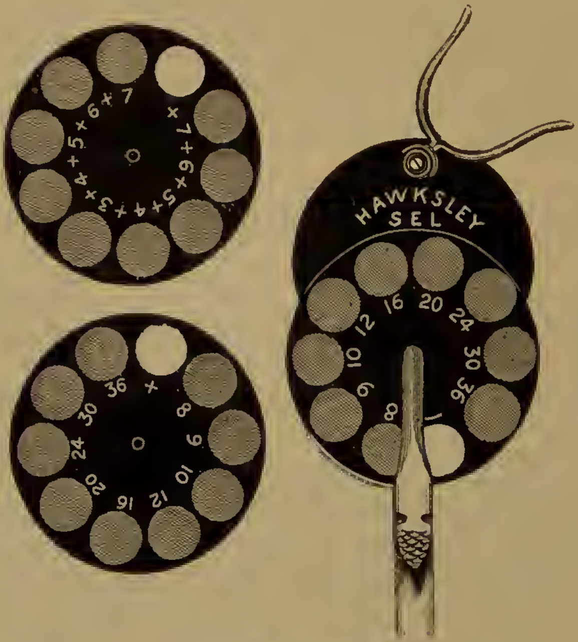
[1] In these diagrams φ'' shows posterior focal points of the dioptric system—*j* in *b* and *c* the abnormal position of the retina.

Ciliary muscle.

talline lens, the curvature of which can be increased to a considerable extent; the alteration of curvature is brought about by the action of a ring of inorganic muscular fibres, situated between the sclerotic and choroid, just external to the greater circumference of the iris. This ring is known as the *ciliary muscle.* The manner in which the ciliary muscle acts upon the lens is as yet a disputed point, one theory being that the lens is maintained in a flattened condition by tension of its suspensory ligament as long as the eye is adjusted for a distant object; that upon accommodation for a near one the ligament is relaxed by contraction of the muscle, and the curvature of the lens (more especially that of its anterior surface) increased by virtue of its own elasticity. The other theory is that the ciliary muscle compresses the lens in some manner, and so alters its curvature.

Mechanism of accommodation.

FIG. 81.



Oldham's ophthalmoscope.

Accommodation is accompanied by convergence of the optic axes from the action of the internal recti muscles, and by contraction of the pupil.

Diseases of Accommodation.

Paralysis of accommodation.

Paralysis of accommodation is met with in cases of paralysis of the third nerve, accompanied by ptosis, divergent strabismus, and more or less dilatation of the pupil; it may be caused by injuries, as blows on the eyeball itself or in its vicinity; sometimes it is met with without apparent cause, and accompanied by no paralysis of the external ocular muscles; it can always be produced artificially by the use of atropine.

Symptoms.—Dilatation of the pupil, general mistiness of vision, and inability to see near objects plainly, the two latter conditions being capable of correction by use of a convex lens.

TREATMENT.—This depends on the cause; if the paralysis of accommodation be associated with paralysis of other branches of the third nerve, the treatment must be directed against any existing constitutional condition—syphilis, rheumatism, &c.—most improvement being brought about by the use of iodide of potassium in increasing doses, alone or in conjunction with bichloride of mercury. If dependent on injury, the eye should be kept bound up, and inflammatory symptoms treated as they arise. If arising idiopathically, without apparent cause, Calabar bean[1] should be used two or three times a week, in order to stimulate the ciliary muscle to contract. In any case a convex lens may be used if required.

Spasm of accommodation.

Spasm of accommodation is met with in some cases of hypermetropia, and occasionally in myopia; it often masks a considerable amount of hypermetropia, and may at times even make the eye appear to be myopic. If it exist with myopia, the degree of short sight is increased.

Symptoms.—Severe and constant pain in the eyeballs and forehead, increased on any attempt to use the eyes, and associated with some anomaly of refraction (generally hypermetropia), inability to see near or distant objects distinctly, these symptoms being modified or entirely removed by the use of atropine.

TREATMENT.—Paralyse the accommodation by constant use of a strong solution of atropine (gr. iv of sulphate of atropia to ℥j of water), and accurately neutralize any existing anomaly of refraction by suitable lenses.

Field of Vision.

Field of vision.

By the field of vision we understand the area over which objects situated in the same vertical plane can be distinguished, the eye being kept fixed on some point. The limits of the field of vision are marked by the most excentrically placed points of objects, which can still be distinguished, the direction of the visual axis of the eye being unaltered.

Mode of ascertaining the extent of the visual field:—The extent of the visual field is easily measured by one of the two following methods:

Examination of field of vision. With black board.

1. The patient being placed at a distance of twelve inches from a black board about three feet square, having a white cross in its centre, should be directed to look steadily at the cross, which must be situated on a level with the eyes; one eye being closed, the sensibility of the retina of the other should be tested by moving a piece of chalk fixed on a dark handle from all directions towards the cross, a mark being made at the point where the chalk first becomes visible.

The portion of the visual field limited excentrically by a line joining the points at which the chalk is first seen when approaching from every direction is known as the *quantitative field* of vision, in contra-distinction to an area bounded excentrically by much narrower limits, over which objects are distinctly defined, and letters can be read, &c., known as *the qualitative field of vision.*

2. Another very simple and effectual method of investigating the condition of the visual field is conducted as follows:

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[1] The Calabar gelatine is the most convenient form for application.

By comparison with healthy eye.

Having placed the patient in a convenient position, we stand opposite to him, at a distance of about two feet, and, supposing his left eye to be examined, we direct him to look steadily at our right eye, which is opposite to his left; the patient's right eye and our left being kept closed, we then move our hand in various directions in the peripheral parts of the field, and notice if its movements are perceived by the patient at the same distance from the centre as by our own healthy retina.

Care must be taken that the hand is moved in a vertical plane situated midway between our own and the patient's eye, and not nearer one than the other; we must also take care that he keeps his eye fixed.

Supposing that the eye under examination distinguishes all movements of the hand at the same distance from the centre as our own, we decide that his field of vision is normal; but if a falling off is noticed in any particular direction, we infer that the sensibility of the corresponding portion of retina is impaired.

It must be remembered that each part of the visual field corresponds to a part of the retina opposite to, and not on the same side as, the object seen; *e.g.*, suppose that the movements of the hand are not perceived in the outer half of the field, the inner half of the retina is defective, and *vice versâ*.

Limitation of field of vision.

It must also be borne in mind that the height of the bridge of the nose has a considerable influence in limiting the inner half of the visual field. Limitation or contraction of the visual field is a very constant accompaniment of retinal changes; it is also one of the earliest symptoms of glaucoma, and occurs as a physiological condition with advancing age.

Towne's stereoscopic test for the retina.

Stereoscopic test for the retina.—A very simple and effectual method of testing the sensibility of the retina has been devised by Mr. Joseph Towne, of Guy's Hospital. Mr. Towne's method of examination consists in presenting simultaneously to non-corresponding halves of the two retinæ similar objects.

The examination is carried out by means of a stereoscope, provided with two slides; on each slide are two white semicircles described upon a red ground, those on the one slide being so contrived that when looked at through the stereoscope they correspond to the nasal halves of the two retinæ, whilst those on the other slide correspond to the two malar halves. In cases of want of sensibility of the whole or any part of the retina, from whatever cause arising, a portion or the whole of one or both semicircles corresponding to the affected portion of retina appears misty or entirely obscured. The degree and extent of the mistiness or obscurity is governed by the degree of insensibility and extent of the impaired portion of retina. Mr. Towne has made "The Stereoscopic Test for the Retina" the subject of some very interesting papers in 'Guy's Hospital Reports,' series iii, vols. xi, xii, xiv, xv.

DISEASES AND INJURIES OF THE EYEBALL AND ITS APPENDAGES.

Several of the more important affections of the organ of vision will be briefly alluded to in future pages; the present section is devoted to a short description of those diseases and injuries which (with a few exceptions, *e.g.* glaucoma) do not call for operative interference.

THE EYELIDS.

Eyelids.

Congenital anomalies.

Congenital anomalies.—Absence of the eyelids; a failure of closure of the fœtal fissure, leaving a cleft in one or both lids (coloboma); ptosis, complete or partial; development of a third lid; pigment spots, moles, hair, and warty growths, have all been occasionally met with.

Ulcers.

Ulcers, primary syphilitic sores (chancres), secondary ulceration, and cancerous ulcers, are sometimes met with. The two former require to be treated on general medical principles; the latter by operation, if the disease have not proceeded too far.

Lice.

Phthiriasis.—The pediculus pubis (crab louse) is sometimes found amongst the eyelashes close to the margin of the lids. The edges of the lids appear to be covered with scabs and crusts somewhat resembling tinea; on close examination the insects themselves will be discovered adhering closely to the margin of the lids, their eggs being attached to the lashes near their bases.

Treatment.—The daily use of some kind of mercurial preparation, none being better than the Ung. Hydrarg. Ammoniatum.

Affections of orbicularis muscle.

Paralysis of the orbicularis muscle occurs in cases of facial paralysis; there is inability to close the eye, the lower lid falls away from the globe, there is considerable collection of lachrymal secretion at the inner canthus, and constant watering of the eye consequent on the displacement of the lower tear punctum.

Treatment.—General medical treatment should be adopted.

Spasm.

Spasm of the orbicularis muscle may occur from long-continued intolerance of light, consequent on affections of the cornea.

Treatment must be directed against the corneal affection. (*See* Diseases of the Cornea.)

Spontaneous twitching, more especially of the lower lid, popularly known as "live blood," is met with in some cases of hypermetropia, or in persons whose digestions are out of order; it is very probably a symptom of undue contraction of the ciliary muscle.

Treatment.—Correction of existing hypermetropia, instillation of atropine, and attention to the general health.

Inflammation of eyelids.

Inflammation of the eyelids may occur during or after acute diseases (measles, scarlatina, &c.), in the course of erysipelas, as the result of injuries, or in connection with severe inflammation of neighbouring parts, *e.g.* purulent ophthalmia. The swelling and redness are usually considerable, and the eye cannot be opened; the inflammation generally ends in resolution, but may (especially if it result from measles, scarlatina, &c.) go on to the formation of abscess.

Treatment.—Locally, fomentations with hot water or decoction of poppy heads; if an abscess forms, it should be opened—preferably through the conjunctiva.

The patient's general health should also be attended to.

Stye.

Stye ("hordeolum") is a small red and painful swelling situated on the outer surface of the lid, or near its margin; it is caused by a circumscribed inflammation of the lid, dependent on morbid change in the Meibomian glands. Styes generally occur in weakly delicate persons; several may appear simultaneously, or there may be a succession of them; they give rise to considerable irritation and are often extremely painful. The inflammation usually goes on to suppuration.

Treatment.—Fomentations, poultices, the administration of tonics, and good living. When pus has formed, the little tumours should be opened.

Tinea.

Tinea (ophthalmia tarsi).

Patients suffering from tinea present themselves with yellowish-brown dry crusts hanging to the eyelashes, which have often dropped out to a considerable extent.

In old cases the margins of the lids are much thickened, giving rise to displacement of the tear puncta and consequent watering of the eye; on removing the crusts the margin of the lid will be found ulcerated, fissured, and easily bleeding. The disease consists in inflammation and ulceration about the roots of the lashes; it runs a very chronic course, often lasting for years in spite of remedies.

Treatment.—Slight cases can generally be cured by the use of a lotion containing 4 to 6 grains of alum to the ounce of water, applied three or four times a day, and of mild nitrate of mercury ointment smeared along the margin of the lids night and morning.

The patient should be directed to remove all the crusts before applying the ointment.

More severe cases should be treated by pulling out the lashes and removing the scabs with forceps, and applying solid nitrate of silver to the raw surface left.

Wounds.

Injuries.—Wounds of the eyelids, however extensive or ragged, should be brought accurately together, and will usually heal readily enough. If there be any loss of substance, care should be taken to prevent contraction of the subsequent cicatrix distorting the lid.

Ecchymosis.

Ecchymosis of the lids (black eye) frequently occurs as the result of blows and may be caused by leech bites or operations.

Treatment.—Most cases may be left alone, but if it is desirable to get quickly rid of the effused blood a poultice made of equal parts of the scraped root of black bryony and bread crumbs should be applied. The poultice should be kept on as long as the patient can bear it. The application is often accompanied by a good deal of stinging pain.

Emphysema.

Emphysema of the lids sometimes occurs from rupture of the mucous membrane of the nose, air being forced into the cellular tissue of the eyelids, or on sneezing, or blowing the nose. Gentle pressure with cotton wool and a bandage, and avoidance of violent expiratory movements, sneezing, &c., is the only treatment required.

The lachrymal apparatus. — The principal affections of the tear passages, &c., will be described in the next section.

THE CONJUNCTIVA.

Ophthalmia.

Ophthalmia.—Under this head are collected all the different forms of inflammation of the conjunctiva; certain characters are common to all. These are more or less vascularity of the membrane, uneasiness and stiffness of the lids, pain of a smarting character, some kind of discharge, and gumming together of the lids during sleep.

Inflammation of the conjunctiva has to be distinguished from inflammation of the sclerotic or subconjunctival fascia, or the injection of these structures which is present in many of the inflammations of deeper parts of the globe. The distinction can be made by paying attention to the following points:

Diagnosis.

1. The inflamed conjunctiva is bright red, the vessels are large and tortuous, and anastomose freely, forming a dense network; they are of greater calibre about the fornix, and taper off towards the cornea.

The inflamed sclerotic or episcleral tissue is pinkish or bluish in colour; the vessels are small and straight, and the vascularity is usually most marked in a ring around the eyeball, just external to the corneal margin.

2. The vessels of the conjunctiva can be somewhat displaced, and made to glide over the surface of the eyeball by gentle pressure; those situated in deeper parts cannot be made to alter their positions.

3. The pain in inflammation of the conjunctiva is of a smarting character, dull and aching, and often very severe in inflammations of deeper parts.

Treatment.

Treatment.—Inflammations of the conjunctiva are best treated by astringent applications.

Any of the following formulæ may be employed:

Astringent applications.

Strong Alum Lotion.

Alum, gr. x; Water, ℥j.

Useful in cases of purulent ophthalmia.

Alum Lotion.

Alum, grs. iv to vj; Water, ℥j.

Sulphate of Copper Drops.

Sulphate of copper, gr. ij; Water, ℥j.

Sulphate of Zinc Drops.

Sulphate of zinc, gr. ij; Water, ℥j.

Nitrate of Silver Drops.

Nitrate of silver, gr. j; Water, ℥j.

Chloride of Zinc Drops.

Chloride of zinc, gr. ij; Water, ℥j.

Most useful in cases of chronic ophthalmia.

Atropine and Astringent Solution.

Sulphate of atropia, gr. ½ to gr. ij; Sulphate or chloride of zinc, gr. ij; Water, ℥j.

Useful in cases where iritis or corneitis occurs in the course of ophthalmia.

Any of these remedies may be given to the patient to use himself; they should be applied from three to six times a day, or oftener, and the patient should be directed to wash away all discharge before using any of them, and to take care that the lotion goes well between the lids.

Some kind of ointment (spermaceti or mild nitrate of mercury, &c.) should also be ordered to be smeared on the margins of the lids at night, to prevent their becoming gummed together during sleep.

The condition of the patient's general health should also be attended to.

Other applications, which should be used by the Surgeon himself, are—

Mitigated nitrate of silver stick.

The mitigated nitrate of silver stick (consisting of nitrate of potash and nitrate of silver, in the proportion of three parts of the former to one of the latter).—*Green stone—lapis divinus* (consisting of equal parts of alum, nitrate of potash, and sulphate of copper, with a small quantity of camphor), and *solid nitrate of silver.* In order to apply any of these the patient should be seated in a chair, the Surgeon standing behind, as in Fig. 82, p. 330; the lid should be everted, and its conjunctival surface thoroughly rubbed over with the substance used. If a preparation of nitrate of silver be employed, the conjunctiva should be washed with salt and water immediately after the application.

Green stone.

Varieties of Ophthalmia.

Catarrhal ophthalmia.

Catarrhal ophthalmia is commonly caused by draughts of cold air, is highly contagious, and acute in its course.

The conjunctivæ, both ocular and palpebral, are highly injected, and sometimes swollen; there may be small extravasations of blood in the structure of the former; there will be a thick, yellow, tenacious discharge.

One or both eyes may be affected, the disease usually commencing in one, and spreading to the other in the course of two or three days.

TREATMENT in the early stages, before there is any amount of discharge.—Some soothing application (as decoction of poppy-heads) should be employed; later on, an astringent should be used, and some mild nitrate of mercury or spermaceti ointment smeared on the edges of the lids at bed-time, to prevent their becoming gummed together during sleep.

The patient (or, in the case of a child, its parents) should be warned of the contagious nature of the disease, and no sponges, towels, &c., which he is in the habit of using, should be used by other people. Among the poorer classes it is very common to see a whole family suffering from catarrhal ophthalmia.

Chronic ophthalmia.

Chronic ophthalmia is usually a sequel of some more acute form; the palpebral conjunctiva is reddened, the ocular conjunctiva presenting patches of slightly increased vascularity, but no general redness, as in cases of catarrhal ophthalmia; the lids are often somewhat thickened, and the caruncle and semilunar fold swollen. There is slight mucous discharge, which forms dry crusts on the margins of the lids, and, at the inner canthus, overflow of tears may occur from obstruction or displacement of the tear puncta.

TREATMENT, the same as that of catarrhal ophthalmia. The disease may continue for almost any time, and when one remedy appears to have lost its effect another should be tried.

Phlyctænular ophthalmia.

Phlyctænular ophthalmia is usually met with in children and young adults, especially females; the disease is characterised by the existence of small whitish elevations situated on the conjunctiva, most commonly near the margin of the cornea; each little elevation has a wisp of blood-vessels leading to it if near the corneal margin, and is surrounded by a zone of vascularity if situated in any other part of the conjunctiva.

There will be some watering of the eye and slight mucous discharge.

Yellow oxide of mercury ointment.

TREATMENT.—In treating phlyctænular ophthalmia our object is to set up a certain amount of irritation of the conjunctiva, by which the phlyctænulæ will be destroyed. This object can be attained by dusting calomel into the eye daily, or by ordering a small quantity of an ointment containing 2 grs. of yellow oxide of mercury to ʒj of lard, to be applied to the inner surface of the lower lid at bed-time. Either of these remedies will soon cause the phlyctænulæ to disappear. The disease, as affecting the conjunctiva covering the cornea, will be spoken of under diseases of that structure.

Granular ophthalmia.

Granular ophthalmia.—This disease occurs at all ages, and is very common amongst the lower classes, especially the Irish; it it is highly contagious. Granular ophthalmia is characterised by the existence of granulation-like bodies on the surface of the palpebral conjunctiva. The granulations present a variety of forms, some being greyish-white and resembling sago grains; others small and red, not unlike the bodies seen on the surface of a granulating sore; others, again, are large, white, and flabby; and a variety is occasionally met with presenting somewhat the appearance of condylomata in other parts.

In old cases, and especially those that have been treated by strong caustics, the conjunctiva may be found converted into a mass of rough cicatrices.

Granulations are always found most developed on the conjunctiva covering the attached border of the tarsal cartilage of the upper lid. Their appearance is more or less altered by treatment; they are accompanied by thick yellow discharge, and there may be more or less severe intolerance of light.

Sequelæ.

Pannus.

Sequelæ, as results of granular ophthalmia.—The cornea may become more or less opaque and vascular, especially at its upper part; the condition is known as "pannus," and is caused by constant irritation of the cornea by the rough surface of the lid.

The conjunctiva may be destroyed to a greater or less extent, extensive cicatrices being formed, which, by their contraction, cause shrinking of the membrane and distortion of the lids, giving rise to entropion and narrowing of the palpebral aperture. The results of granular ophthalmia are frequently aggravated by unskilful treatment.

Treatment.

TREATMENT.—In treating granular ophthalmia our object is to destroy the granulations, and do as little damage as possible to the conjunctiva itself.

The use of strong caustics must be carefully avoided, as they cause too much destruction of tissue, followed by the formation of cicatrices and subsequent contraction.

Slight cases can be cured in a short time by the application of mitigated nitrate of silver stick twice a week, or oftener, and the use of sulphate of copper drops from three to six times a day.

Duration of attack.

More severe cases will remain under treatment for months or years, but if persevered with will usually get well. If the ophthalmia be of recent date the granulations should be touched twice a week with the mitigated nitrate of silver stick, or, if possible, every day, sulphate of copper drops being used from three to six times daily.

In chronic cases the green stone should be used instead of the nitrate of silver stick.

The application of calomel powder or quinine to the granulations has also been found useful in some cases.

Inoculation.

When the cornea is completely opaque and fleshy looking, inoculation with pus from a case of purulent ophthalmia may be tried, but only in extreme cases, and if only one eye be affected, care must be taken to prevent the other being inoculated.

Occurrence of iritis.

Iritis not unfrequently supervenes in the course of granular ophthalmia; when it occurs a solution of atropine should be dropped into the eye from three to six times daily, in addition to the other remedies.

Pannus requires no special treatment, and disappears as the granulations are cured. In all cases some simple ointment should be applied to the edges of the lids at night, to prevent their becoming gummed together.

Purulent ophthalmia.

Purulent ophthalmia.—Purulent ophthalmia may be met with, as "ophthalmia neonatorum" in children soon after birth, or in older persons. It is highly contagious. In the former case it may be caused by contact of acrid vaginal secretions, by want of cleanliness and fresh air, or a combination of the two; in the latter by contact with some form of specific pus, or by constant irritation of the conjunctiva.

The worst form of the disease, whether occurring in infants or older persons is that caused by inoculation with gonorrhœal matter.

Ophthalmia neonatorum.

"Ophthalmia neonatorum" makes its appearance a few days after birth; the eyelids are found red or bluish-red and swollen; the eyes can only be opened with difficulty, and on attempting to separate them thick yellow purulent discharge escapes from between their edges; both eyes are almost always affected.

Purulent ophthalmia in older persons may affect one or both eyes; it commences with intolerance of light, lachrymation, and injection of the conjunctiva, at first much resembling an ordinary attack of catarrhal ophthalmia, but in about twelve hours its real nature becomes apparent.

Chemosis.

There will be thick yellow discharge escaping from between the lids, they themselves being swollen and red and sometimes everted; the conjunctiva bright scarlet, traversed by large distended blood vessels, and much swollen, especially the ocular portion (chemosis), which may overlap the cornea and protrude in folds between the lids; there will be pain and intolerance of light; the patient will very probably be much depressed (especially if the attack have lasted long), and is often suffering from gonorrhœa. The great danger to be feared in purulent ophthalmia is implication of the cornea, which may be partially or entirely destroyed by suppuration or sloughing.

Implication of cornea.

Treatment.

Treatment.—In all cases the patients themselves or their parents should be warned of the contagious nature of the disease, and if only one eye be affected the greatest care should be taken to protect the other. If possible, a good view of the cornea should be obtained, as its condition materially influences the prognosis with regard to sight. The examination should be made with care, as the cornea may be ruptured whilst making it.

Treatment.

In ophthalmia neonatorum the only treatment required is to wash out the eyes every hour or half hour with strong alum lotion until the discharge is lessened; the lotion need only be used thus frequently for twelve hours out of twenty-four (from 8 a.m. to 8 p.m.), the child being allowed to sleep at night; as the discharge gets less the lotion may be used less frequently. Some simple ointment should be applied to the margins of the lids once or twice a day to prevent them from sticking together.

Slight cases of purulent ophthalmia in older persons may be treated in the same manner, but the more severe forms (especially the gonorrhœal) require that much more energetic measures should be taken.

The treatment should be both local and constitutional.

Application of nitrate of silver.

Local treatment (when the patient is first seen):—The lids should be everted, and the whole conjunctiva brushed over with a stick of solid nitrate of silver, or painted with a solution of 40 to 60 grains of the salt to ℥j of water, the application being repeated in the course of two or three days if no improvement have taken place. The patient should be kept lying down in a dark room, and a bag of ice or lint kept wetted with iced water applied over the closed lids; the ice or lint should be removed and the eyes washed out every hour or half hour with some astringent lotion, the greatest cleanliness being observed.

Abstraction of blood.

If there be much pain, and the patient be strong, blood may be taken from the temples by leeches or the application of the artificial leech, but, as before stated, most patients suffering from severe purulent ophthalmia are much depressed and will not bear depletion.

Constitutional treatment.

Constitutional treatment.—The free administration of tonics, especially iron and quinine, with good living, and a fair amount of stimulants.

If perforation of the cornea threaten or have taken place, the eye should be kept firmly bandaged, so as to prevent as much as possible escape of the contents of the globe.

Diphtheritic ophthalmia.

Diphtheritic ophthalmia.—This form of ophthalmia is but rarely met with in London; it affects persons of all ages. At first sight the case appears to be one of severe purulent ophthalmia; its chief characteristic, however, is a solid infiltration of the substance of the conjunctiva, with or without the formation of diphtheritic membranes on its surface. The affected eye is frequently lost from implication of the cornea. The disease is best treated by sedative applications, as fomentations of poppy heads, or belladonna, attention being paid to the patient's general health.

Injuries.—Wounds of the conjunctiva usually heal readily enough, requiring only simple treatment.

Burns.

Burns are usually caused by contact of lime or hot metals; the damage done may be only slight, or the whole conjunctiva and cornea may be converted into a dead white slough.

TREATMENT.—The conjunctiva should be carefully examined, and all foreign bodies and portions of sloughy tissue removed, and if the

Lime. injury have been caused by lime the surface of the conjunctiva should be carefully cleaned with a weak solution of acetic acid or simple warm water. Some oil should be placed between the lids, and the eye bound up with wet lint and a bandage. If any symptoms of iritis appear, a solution of atropine should be dropped into the eye from three to six times a day. Should there be much discharge alum lotion may be used.

Prevention of adhesions. When the sloughs have separated care must be taken to prevent adhesions between the raw surfaces left, by passing a probe between the lids and eyeball once or twice a day, and directing the patient to draw the lid away from the globe frequently.

Foreign bodies. *Foreign bodies*, small pieces of coal, iron, &c., are sometimes found embedded in the conjunctiva, and must be removed.

Hæmorrhage. *Hæmorrhage* into the substance of the conjunctiva or beneath it may occur spontaneously, or from injury; no treatment is necessary; the patient may be assured that no harm will come of it, and that the blood will disappear in the course of a week or longer.

External muscles.

EXTERNAL MUSCLES OF THE EYEBALL.

Strabismus will be considered in the next section.

Nystagmus. **Nystagmus** signifies a peculiar involuntary quivering motion of both eyes, dependent on rapid contraction of antagonistic pairs of muscles. The disease is usually developed in infancy, and is always associated with considerable impairment of vision, arising from congenital cataract, opacity of the cornea after purulent ophthalmia, atrophy of choroid, &c.

TREATMENT.—Nothing can be done to remedy nystagmus.

Paralysis and paresis. **Paralysis and paresis.**

Paralysis signifies total loss of power of the affected muscle; paresis, only partial loss.

The causes are affections of the brain or spinal cord; diseases within the orbit, as tumours, or periostitis, pressing on the nerves supplying the muscles, and affections of the nerves themselves or of the muscles. As a rule, the cause of the paralysis or paresis can only be conjectured, but very many cases will be found connected with syphilitic diseases.

Treatment. TREATMENT.—A careful inquiry should be made into the patient's previous history, and remedies given in accordance with this, those of an antisyphilitic nature being generally required. If the affection have not lasted more than three months a favorable prognosis may be given, but if, on the contrary, it have existed six months or more, recovery is very improbable.

Insufficiency of internal recti. **Insufficiency of the internal recti muscles** gives rise to somewhat obscure symptoms, which have been mistaken for manifestations of cerebral disease.

Patients thus affected complain that they cannot do near work for any length of time, as objects looked at become indistinct, or appear double. They suffer from giddiness and pain in the brows and head generally. Insufficiency of the internal recti should always be suspected if in a case of hypermetropia relief cannot be given by the use of glasses.

Treatment. TREATMENT.—Any anomaly of refraction should be accurately neutralized, and the weakened muscles assisted by the use of prisms or of spherical lenses so arranged as to have a prismatic action.

THE CORNEA.

Corneitis.

Inflammation (corneitis, or keratitis).—Five different forms of inflammation of the cornea will be met with :—(1) Simple corneitis, (2) interstitial or parenchymatous corneitis, (3) pustular corneitis, (4) keratitis punctata, (5) corneitis with sloughing or suppuration.

Symptoms.

Symptoms.—Corneitis is characterised by watering of the eye, impairment of vision, intolerance of light, and pain, sometimes severe, at others insignificant; on examination more or less of the cornea will be found cloudy or quite opaque, and blood-vessels may be seen in its substance or on its surface.

Diagnosis.

It is of importance to notice the course and position of the blood-vessels in any case where the cornea has become vascular. If the vessels lie altogether in the cornea, commencing near its margin, and passing for a variable distance in its substance, the case is probably one of interstitial keratitis; but should the vessels be continuous with those of the conjunctiva, pass over the margin of the cornea, and lie superficially on its surface, the vascularity is probably due to mechanical irritation from granular lids or inverted lashes, and the condition known as *pannus* is present.

It is very necessary that the difference between these two forms of vascularity should be recognised, as their treatment varies widely.

In the former case the treatment of keratitis, to be presently described, should be adopted; in the latter treatment must be directed against the cause of the vascularity (granular lids, &c.).

Simple corneitis.

Simple corneitis may be caused by injuries, or the lodgment of foreign bodies on the surface or in the substance of the cornea. There will be some pain, intolerance of light, and lachrymation, and some part of the cornea will be found occupied by a halo of dulness.

Interstitial keratitis.

Interstitial or parenchymatous keratitis (corneo-iritis, syphilitic keratitis, keratitis).

Interstitial keratitis occurs in persons who are affected by hereditary syphilitic taint; it is frequently but by no means invariably associated with notched teeth, flattened nose, fissures around the angles of the mouth, or other manifestations of congenital syphilitic disease.

It usually first makes its appearance between the fifth and eighteenth years, and always affects both eyes, either simultaneously or at short intervals; it runs a very chronic course and is most intractable, a severe attack often lasting from twelve to eighteen months.

Symptoms.

Symptoms.—Interstitial keratitis presents all the symptoms of inflammation of the cornea in a marked degree. The opacity is peculiar, and is caused by infiltration of the substance of the cornea with opaque material.

At first the cornea becomes spotted in its centre, but the spots soon run together, forming a greyish haze; opacity then commences at the upper and lower corneal margins, and gradually spreads, until the whole structure resembles somewhat a piece of ground glass, apparently blood-stained in parts, from the development of innumerable minute blood-vessels. There is always a well-marked band of ciliary injection. Interstitial keratitis is not unfrequently complicated by iritis hence the name "corneo-iritis."

The opacity having reached a certain point, may remain stationary for months, but at length clearing commences, and the cornea regains more or less of its normal transparency; recovery always taking place to a much greater extent than would be at first expected.

Pustular corneitis.

Pustular corneitis (phlyctænular, strumous, vascular, corneitis; strumous ophthalmia).

Pustular corneitis is met with in children and young adults; it often follows measles, scarlatina, or other acute diseases; it is frequently accompanied by eczematous eruptions on the eyelids, about the nostrils and angles of the mouth, and on the head; the patients often present well-marked strumous diatheses, and are generally said to be delicate.

Symptoms.

Symptoms.—In most cases there will be profuse lachrymation and great intolerance of light; the lids may be swollen, covered with eczematous eruptions, and tightly screwed up, so as to cause the greatest difficulty in examination.

There will be more or less injection of the ciliary region (ciliary redness). Upon the surface of the cornea may be found (1) small greyish elevations (phlyctænulæ); (2) phlyctænulæ in a state of suppuration (pustules); (3) small ulcers left on discharge of the contents of the latter. Any of these are usually found in greatest quantity round the margin of the cornea, but its whole surface may be found dotted over with phlyctænulæ, pustulæ, or ulcers, or examples of all three may be met with in the same eye. There will be more or less haziness and vascularity surrounding the affected portions of cornea. In some cases there is thick mucous or muco-purulent discharge in addition to the lachrymation.

Cases of pustular corneitis, accompanied by great intolerance of light, much swelling of the eyelids, profuse lachrymation, and thick muco-purulent discharge, occurring in strumous children, are sometimes described as a separate disease under the name of "strumous ophthalmia."

Pustular corneitis is very likely to recur.

Keratitis punctata.

Keratitis punctata occurs in young adults, never in children; it much resembles the early stages of interstitial keratitis; as a rule, one eye only is affected; there will be the usual symptoms of corneitis, but the intolerance of light is not very severe; the cornea will be found dotted over with small greyish opacities which are collected most thickly in its central portion. The disease is most intractable, and may be accompanied by iritis.

Suppurative corneitis.

Corneitis with sloughing or suppuration is usually the result of sharp blows, as flicks from twigs, &c., or is caused by the irritation of foreign bodies, as the husks of corn; it may also occur after operations for cataract.

Symptoms.—Those of corneitis, severe pain being one of the most marked; some part of the cornea will be found occupied by a collection of pus, part of which may have escaped into the anterior chamber and collected at its lower part, giving rise to the condition known as "hypopion;" or the pus may have gravitated down between the layers of the cornea to its lower margin, forming a collection much resembling hypopion and known as "onyx."

Hypopion.

Onyx.

Instead of a collection of pus, some part of the cornea may be found occupied by a dead white slough, or large ulcerated and sloughing surface.

The iris may also be inflamed and suppurating. Suppurative corneitis is met with in cases of *neuro-paralytic ophthalmia;* a peculiar form of inflammation, associated with paralysis of the ophthalmic division of the fifth nerve, and consequent anæsthesia of the parts supplied by it. Neuro-paralytic ophthalmia.

Treatment.—The treatment of corneitis should be both local and constitutional. Treatment.

Local treatment.—All foreign bodies or other sources of irritation should be removed; the eyes must be protected from light by a large shade, protectors, or better still by a bandage. Sedative applications should be employed, none being better than belladonna lotion, containing from 6 to 10 gr. of extract of belladonna to the ounce of water; or, if preferred, a weak solution of atropine, gr. ½ to a pint of water, may be used instead; the eyes should be bathed three or four times a day with either of these, and kept bound up with lint wetted with one or the other. Local. Belladonna lotion.

If iritis exist, a stronger solution of atropine, gr. ½ to gr. ij or iv to the ounce of water, should be dropped into the eyes as often as may appear necessary.

In corneitis with suppuration warm applications will be found most beneficial; the eye should be well bathed with warm belladonna lotion or decoction of poppies several times a day, and bound up firmly with lint, soaked in one or the other. If pain be a prominent symptom it may be greatly relieved by taking blood from the temples.

In cases of corneitis, especially of the interstitial and pustular forms, when there is obstinate intolerance of light, which will not yield to the above treatment, a seton should be placed in the skin of the temple on one or both sides (*see* p. 332). Seton.

If in a case of suppuration or sloughing perforation of the cornea appear imminent, iridectomy should be performed (*see* p. 349). Iridectomy.

Constitutional treatment.—Simple corneitis requires no constitutional treatment. In the interstitial form antisyphilitic remedies should be employed, none being better than the bichloride of mercury in doses of one sixteenth to one twelfth of a grain, combined with bark or other tonic, and given twice or three times a day. Constitutional.

The other forms of corneitis, especially the pustular, are best treated by the administration of tonics, as steel wine, tincture of perchloride of iron, quinine, &c.; and in strumous children cod-liver oil should also be prescribed, with good living and plenty of fresh air.

Ulcers of the cornea present a great variety of forms. They may be transparent or opaque; they may be healing, indolent, vascular, or sloughing. The depth to which the corneal tissue is destroyed varies from slight abrasion of its surface to destruction of its whole thickness, causing perforation. The area of the cornea which is affected also varies from a small point to destruction of the whole surface. Ulcers of the cornea.

Ulcers are sometimes described as marginal or central, according to their position. Ulceration of the cornea is constantly met with in cases of debility, from whatever cause arising. It is very common in patients recovering from acute diseases, as measles, scarlatina, and more especially smallpox. Children are much more frequently affected than adults.

The symptoms of ulceration are very similar to those of corneitis. On examination any kind of ulceration may be found (one variety has

Transparent ulcer.

been mentioned under Pustular corneitis). There may be one or more small *transparent ulcers,* which can only be seen in certain lights, and are very likely to be overlooked. They appear like small abrasions of the epithelium; sometimes the greater part of the surface of the cornea is found to be affected either by several small transparent ulcers or one large one. This form of ulceration is most commonly met with in adults of irritable, nervous temperament, and should always be carefully looked for when a patient of this description presents himself suffering from severe intolerance of light, watering of the eye, and smarting pain, without any very apparent cause.

Opaque ulcer.

Opaque ulcers are visible enough; they may be of any size or number. Sometimes they appear to be healing, in which case the edges appear smooth and the surface of the ulcer rough and opaque or cloudy. At others they are indolent, and again they may be spreading, when their edges are found to be clean cut, as if a piece of the cornea had been punched out by some sharp instrument; the surface of the ulcer appears glassy, and is often deeply excavated.

Sloughing ulcer.

Sloughing ulcer is more or less opaque, spreads rapidly, both in area and depth, and if the process be not soon arrested the cornea will be perforated, and a prolapse of the iris of greater or less extent (according to the size of the perforation) will take place. If the opening be large the lens or some of the vitreous may escape.

Anterior synechia.

Staphyloma.

In the greater number of cases of perforation of the cornea the iris pushes forward, fills the opening, and becomes adherent to its margins, forming an "anterior synechia," or a considerable prolapse may take place, forming a "staphyloma."

Crescentic ulcer.

Marginal or crescentic ulcer is a somewhat peculiar form of corneal ulceration; it is met with in persons of middle age, is very intractable, and very liable to recur or relapse. This form of ulceration is accompanied by very severe pain, great intolerance of light, and very profuse lachrymation. On examination a crescentic patch of ulceration is found skirting generally the upper margin of the cornea; the ulcer is deep, its margin clean cut, and its surface glassy looking.

The ulceration spreads rapidly up to a certain point—remains stationary for a time, and then commences to heal slowly, the healing process being frequently interrupted by relapses.

The ulcerative process may involve both the upper and lower segments of the cornea, but never passes up to its centre.

Treatment.

TREATMENT.—The treatment of ulcers of the cornea is similar to that of corneitis, but in all cases it is better to keep the eye carefully bandaged.

Opacities of cornea.

Opacities of the cornea are the result of inflammation, ulceration, or injury.

Nebulæ.

Leucoma.

They are met with of all densities and sizes; thin cloudy opacities are known as "nebulæ," dense white ones as "leucomata." A dense white opacity, involving the whole cornea, is called a "total leucoma;" an opacity of the same description occupying a part only, a "partial leucoma." Should a corneal opacity have been caused by a perforating ulcer or wound of the cornea, an "anterior synechia" will probably be found associated with it.

Fleshy opacities.

Fleshy opacities are sometimes met with near the margin of the cornea, and continuous with the conjunctiva. They are composed of granulation tissue, and are frequently the result of burns.

Treatment. TREATMENT.—Corneal opacities have always a tendency to disappear, especially in children. Their removal may be aided by the use of slightly irritating applications, which set up a certain amount of increased vascularity, and thus aid absorption. The remedies generally employed are drops of sulphate of copper, iodide of potassium, or opium; turpentine, pure, or mixed in various proportions with olive oil; calomel powder, or the yellow oxide of mercury ointment. Any of these may be used for some considerable time. If no improvement have taken place at the end of two or three months, and the opacity be so situated as to interfere with vision, an artificial pupil must be made, or if the opacity be disfiguring it should be tinted (*see* pp. 348). The fleshy opacities may be removed by operation, but are very liable to reappear in their former site.

Abrasions. **Injuries.**—Abrasions of the cornea may be caused by scratches from thorns, ends of straw, finger nails, &c. They give rise to severe pain, much intolerance of light, and watering of the eye.

TREATMENT.—Some oil should be placed between the lids, and the eye kept carefully bandaged till the abrasion has healed.

Penetrating wounds. Penetrating wounds of the cornea generally involve the iris or lens; in the former case an adhesion of the iris to the cornea (anterior synechia) is likely to be formed, or iritis set up; in the latter the lens will probably become opaque, a traumatic cataract being developed.

Very extensive wounds of the cornea may allow the escape of the lens or vitreous.

Treatment. TREATMENT.—The eye should be kept carefully bound up with lint soaked in belladonna lotion, and in cases where the lens has been wounded, or iritis set up, a solution of atropine, one grain to one ounce of. water, should be dropped into the eye from four to six or eight times daily.

Should the lens swell and cause pain and increase of tension, it must be removed without delay, or iridectomy be performed.

Iridectomy may have to be performed at some future time for optical reasons, or to obviate the irritation caused by dragging on an anterior synechia. Traumatic cataract may also require to be treated.

Burns. Burns of the cornea by lime, hot metals, &c., usually occur in conjunction with like injuries of the conjunctiva; they usually leave behind them opacities of greater or less extent and density, according to the severity of the injury, or may cause sloughing and destruction of the whole or greater part of the cornea.

TREATMENT, the same as that of burns of the conjunctiva.

THE SCLEROTIC AND EPISCLERAL TISSUE.

Episcleritis. Inflammation of the sclerotic or episcleral tissue, or more commonly of both together, is a somewhat rare disease; it is characterised by presence of purple swollen patches, covered by enlarged conjunctival vessels, and situated usually about the insertion of the recti muscles.

The purple patches often disappear from one portion of the globe, and appear again at another; the inflammation is chronic in its course, but subsides after a time, leaving some discoloration of the affected part. This disease is very liable to recur.

TREATMENT.—Sedative applications, as decoction of poppy-heads, or belladonna fomentation, should be used three or four times a day, and if there be much conjunctival vascularity or any mucous discharge some astringent lotion (as chloride of zinc drops) should also be employed.

Any constitutional treatment that may appear called for should be adopted.

This disease is usually described as "episcleritis."

Staphyloma of sclerotic.

Staphyloma of the sclerotic may occur from softening of its structure by inflammatory changes, which usually commence in the choroid.

Staphyloma may be met with in the ciliary region (ciliary staphyloma), about the equator (equatorial staphyloma), or near the optic nerve (posterior staphyloma). Little can be done in the way of treatment.

Wounds.

Injuries.—The sclerotic may be wounded by sharp instruments, or ruptured by blows; in the latter case the lesion usually takes place in the ciliary region, near the upper margin of the cornea.

The sclerotic (as also the cornea) may be pierced by a shot or chip of metal, which may be lodged within the globe or have passed clean through it.

Treatment.

TREATMENT.—The treatment of injuries of the sclerotic depends much upon the extent and nature of the damage done.

Small incised wounds will usually heal readily enough if the eye be kept carefully bandaged. Larger wounds may require to be closed by a suture.

Blows often cause complete disorganization of the globe, the aqueous and vitreous chambers being filled with blood, and hæmorrhage having taken place between the sclerotic and choroid, although no rupture of the external tissue has taken place.

Such cases must be carefully watched, and the eye kept bandaged with lint soaked in belladonna lotion.

In cases of extensive incised wounds, large ruptures, or wounds associated with lodgment of a foreign body within the globe, extirpation of the eyeball will probably have to be performed. (*See* p. 363.)

THE CRYSTALLINE LENS.

Congenital anomalies of lens.

Congenital anomalies.—Variations in shape, absence of the whole (aphakia) or part of the lens, and displacements, are met with as congenital defects.

Presbyopia.

Presbyopia (old sight).—Presbyopia depends on senile change of the crystalline lens, by which it is rendered harder than in youth and its elasticity is impaired. As a consequence its curvature can only be altered to a limited extent by the action of the ciliary muscle, and the power of accommodation is correspondingly diminished.

Persons generally begin to experience the effects of presbyopia about the age of forty-five. The nearest point of distinct vision, which year by year has been receding from the eyes, now comes to stand inconveniently far off, so that small print can only be read with difficulty or not at all, distant vision, however, being still acute.

It has been arbitrarily decided that a person shall be considered presbyopic as soon as his nearest point of distinct vision comes to stand at eight inches or further from the eyes.

If we wish to find exactly what is the nearest point of distinct vision in any particular case, we ascertain the weakest convex lens which renders vision acute at eight inches. Having found this lens, we subtract its power from $\frac{1}{8}$, and the difference shows the distance for which the eye under examination was accommodated without the aid of such a lens. For instance, suppose we have found that with + $\frac{1}{24}$ Snellen 1½ can be read at eight inches, we subtract $\frac{1}{24}$ from $\frac{1}{8}$ $(\frac{1}{8}-\frac{1}{24}=\frac{1}{12})$; in this case twelve inches is the distance for which the eye is accommodated without the aid of a convex lens, and is the shortest distance at which objects can be seen distinctly without spectacles.

Degree of presbyopia.

The *degree* of presbyopia can be expressed by the focal length of the weakest lens which renders vision acute at eight inches in the case supposed: presbyopia = $\frac{1}{24}$.

Treatment.—The inconvenience arising from presbyopia is easily obviated by the use of suitable convex glasses.

For ordinary purposes the weakest lenses, which will allow 1½ or 2 of Snellen to be read at a distance varying between fourteen and eight inches from the eyes, should be ordered. Some persons, however, require to see at some particular distance, in which case those glasses which appear to give the greatest acuteness of vision at the required distance should be given.

Associated with hypermetropia.

If hypermetropia be present, its *degree* must be ascertained, added to the *degree* of presbyopia, and glasses strong enough to neutralize both ordered for all near work. For instance, suppose we have ascertained the existence of H. $\frac{1}{30}$, and besides this Pr. $\frac{1}{30}$; we add the two together, and give glasses of $\frac{2}{30}$, *i.e.* $\frac{1}{15}$.

Traumatic cataract.

Injuries.—Opacity of the lens (traumatic cataract) may be caused either by penetrating wounds of the cornea or simply by concussion.

Dislocation of the lens.—As the result of blows upon the eyeball, the lens may become partially or entirely displaced; it may, however, still retain its transparency, but often becomes more or less opaque.

Displacement of lens.

Displacement of the lens may take place forwards into the anterior chamber, backwards into the vitreous, or it may be entirely extruded from the globe through a wound in the sclerotic, and lie beneath the conjunctiva.

In displacement forwards the pupil will be found dilated, irregular in shape, and fixed; oblique illumination will show the lens lying partially or entirely in the anterior chamber.

In displacement backwards the iris will be tremulous, the pupil sluggish, and the anterior chamber deepened. Direct ophthalmoscopic examination will probably detect the lens lying in the ciliary region at the lower part of the eye.

In displacement beneath the conjunctiva the lens is found forming a small rounded tumour, somewhere near the corneal margin, most frequently at its upper part.

Treatment.

Treatment.—If the lens be displaced into the anterior chamber, and still retain its transparency, it may be left alone. But should it become opaque or appear to be setting up irritation, it should be removed by extraction, preferably associated with iridectomy. A transparent lens may remain for years in the anterior chamber, and, with the exception of impairment of vision, give rise to no inconvenience. If its capsule have been lacerated, however, it will become opaque, and if not extracted will gradually be removed by absorption.

A lens displaced into the vitreous chamber should, if possible, be left alone; but it will very probably act as a foreign body and set up glaucomatous changes, in which case it should be removed at all risks.

A lens displaced beneath the conjunctiva may be left to itself.

Cataract will be considered in the section on operations.

THE IRIS AND CHOROID.

Coloboma.

Congenital Anomalies.—**Coloboma** signifies a cleft condition of the iris or choroid, dependent on failure of closure of the fœtal fissure. In the former it occurs as a deficiency of the lower segment, appearing as if iridectomy had been performed downwards. In the latter it is seen (on examination with the ophthalmoscope) as a brilliant white figure, commencing at the optic disc, and continuing downwards and forwards for a variable distance towards the ciliary processes, through which, in extreme cases, the cleft may extend, and be even continuous with a similar deficiency of the iris.

The albino.

In the **Albino** the pigment of the iris and choroid is absent to a greater or less extent, and with the ophthalmoscope the fundus of the eye appears of a yellowish-white colour.

Irideremia.

Irideremia, or congenital absence of the iris, is occasionally observed.

Persistence of pupillary membrane.

Persistence of the pupillary membrane.—Small portions of the membrane which at a period of fœtal life covered the pupil may occasionally remain. One or more fine threads, somewhat resembling cobwebs in appearance, may be seen passing across the pupillary area, and attached at either end to the anterior surface of the iris, near the margin of the pupil.

Anomalies of colour.

Anomalies of colour.—The iris of one eye may be brown, that of its fellow being blue, or differences in colour may occur in different parts of the same iris.

Tremulous iris.

Tremulous iris (**iridodonesis**) signifies a tremulous condition of the iris, which shakes about as the eye is moved. This condition is met with when the iris has lost the support of the crystalline lens, when the vitreous humour is abnormally fluid, or the iris totally paralysed.

Tumours of iris.

Tumours seldom originate in the iris itself, but its structure often becomes implicated by growths commencing in deeper parts of the globe (*see* Tumours of Eyeball); but instances of malignant growths, sebaceous tumours, simple cysts, and of the cysticercus, have been met with in the iris.

Paralysis of iris.

The term *paralysis* should, strictly speaking, be applied only to cases where the iris is tremulous, all its movements being destroyed and the pupil of moderate size; but it is often used in the condition of dilatation of the pupil met with in cases of paralysis of the third nerve; in which, however, only the circular fibres are affected.

Mydriasis signifies abnormal dilatation of the pupil; **Myosis**, abnormal contraction.

Inflammation of the Iris (Iritis).

Causes.

Causes.

Local.—Irritation from foreign bodies in the conjunctival sac or cornea; friction of the cornea by granular lids or inverted lashes; injuries of the iris itself by operations, or by accidents, with or without the lodgment of foreign bodies in its substance or on its surface; pressure by a swollen crystalline lens, and exposure from perforation of the cornea.

Constitutional.—Debility, after acute disease, from over-lactation, &c.; certain specific diseases, as syphilis, rheumatism, and gout.

Symptoms.

Symptoms.—Certain symptoms are met with in most cases of iritis; these are change of colour, cloudiness and loss of polish of the iris, sluggishness or complete immobility and (as a rule) contraction of the pupil, injection of ciliary region (ciliary redness), watering of the eye, and impairment of vision. Other symptoms met with occasionally are pain, intolerance of light, irregularity in outline of the pupil, new growths visible to the naked eye, and the production of pus.

Varieties of iritis.

Three varieties of iritis are commonly met with. 1. Simple iritis. 2. Recurrent or rheumatic iritis. 3. Syphilitic iritis.

Simple iritis.

Simple iritis.—All the more constant symptoms of iritis are present, often accompanied by more or less severe pain. An uncomplicated attack may last from one to two weeks or longer; a few adhesions may form between the iris and lens-capsule (posterior synechiæ), but the inflammation usually ends in resolution, the iris quite recovering its normal condition. In this as well as in the other forms of iritis, however, the inflammation may run on to the formation of a considerable quantity of new material or into suppuration.

Recurrent iritis.

Recurrent or rheumatic iritis occurs in persons who are subject to attacks of rheumatism or gout, and also in the children of rheumatic or gouty parents; an attack of this form of inflammation presents all the more constant symptoms of iritis, and has one character peculiar to it, viz. its recurrency, some patients having had as many as twenty or more separate attacks; in some cases the attacks observe a remarkable periodicity, recurring regularly at the same time of year. The inflammation sometimes appears in one eye, sometimes in the other, or perhaps in both, rarely, however, simultaneously, but at short intervals, the second one becoming affected long before the first has begun to recover. Recurrent iritis is frequently accompanied by more or less haziness of the cornea and also of the aqueous humour. In some cases very severe pain of a dull aching character is experienced in the eyeball, forehead, side of nose, and temple; in others the attack is most insidious, the patient's attention not being attracted until a considerable amount of new material has been thrown out, extensive adhesions formed, the sight of one eye much impaired and the inflammatory action extended to the other. Tho great feature of this form of iritis is its recurrency.

Haziness of cornea.

Syphilitic iritis.

Syphilitic iritis is, perhaps, the most common of all the forms.

A typical case presents all the constant symptoms of iritis in a very marked degree, the zone of ciliary redness being extremely well defined. There may be, besides, certain peculiar nodular excrescences, of a dirty yellow colour (known as lymph-nodules), situated on the surface of the iris or at its pupillary margin, and sometimes extending into the pupil, which may be completely blocked by them. Their existence renders the diagnosis of syphilitic iritis certain; they are, however, only occasionally present, and in the greater number of cases met with the Surgeon will have to take into consideration the patient's previous history,

Lymph-nodules.

ascertain the existence of other signs of syphilis, and make his diagnosis accordingly.

Syphilitic iritis occurs most frequently between the ages of fifteen and forty, but is occasionally met with as a manifestation of congenital syphilis in infants.

Results of iritis.

Results of iritis.—In many cases, especially if early and properly treated, perfect recovery takes place; in others permanent signs of inflammation are left. The morbid changes more commonly met with are—

Atrophy of iris, &c.

(1) The iris itself may be found *atrophied*, *rigid*, or *rotten*, and very prone to bleed freely on the slightest wound. These conditions become most apparent when operating upon its structure. On attempting to perform iridectomy considerable difficulty will be experienced in removing a portion of the iris, which may be so tough that none of it can be torn away, or so rotten that only the portion included between the branches of the forceps is removed; or hæmorrhage may take place to such an extent as to prevent the completion of the operation.

Posterior synechia.

(2) *Adhesions to neighbouring parts* ("*synechiæ*") may have formed, those most commonly met with being between the iris and lens-capsule ("posterior synechiæ").

Posterior synechiæ are generally situated at the pupillary margin, and may vary in extent from a few adherent tags, of this part only, to complete adhesion of the whole posterior surface of the iris to the lens-capsule, this latter condition being known as "total posterior synechia."

Anterior synechia.

Adhesion of the iris to the cornea, "anterior synechia" (should this occur at all as the result of iritis) will be found about its greater circumference.

Closed pupil.

(3) *Closure of the pupil* by inflammatory material, *opacities upon the lens-capsule* caused by adhesion of the "uvea" detached from the posterior surface of the iris.

Capsular cataract.

(4) Dense inflammatory deposits in or beneath the capsule, or involving the superficial fibres of the lens itself (*capsular cataract*), may also be met with.

Treatment.

TREATMENT.—In treating iritis we must take care, *first*, to remove any local cause, such as a foreign body, opaque swollen lens, &c., and to cure granular lids, or remove inverted lashes. *Secondly*, we must endeavour to dilate the pupil. *Thirdly*, to relieve pain. *Fourthly*, any constitutional treatment that may appear called for should be employed. (The means of carrying out the first indication are detailed elsewhere.)

Local.

In order to dilate the pupil a few drops of a strong solution (gr. iv to ℥j) of atropine should be placed between the eyelids by the Surgeon himself at each visit, and a weaker solution (gr. ¼ to gr. 1 to ʒj) should be given to the patient to use from four to eight or twelve times a day. If the case be seen at the commencement, more or less dilatation of the pupil will usually take place; but should the iris have become infiltrated with inflammatory matter, and adhesions formed, little or no effect will be produced; the atropine should, however, be persevered with.

In cases of iritis with suppuration the eye should be fomented frequently with hot belladonna lotion, and kept bound up with lint soaked in the lotion.

In cases accompanied by much pain blood should be taken from the temples by leeches or the artificial leech. Atropine may give rise to pain by causing dragging upon adhesions; it should therefore be used with caution in cases where its application is attended by much suffering, especially if it have no effect upon the pupil. The eyes should be protected from light by a green shade or protectors until the inflammation has subsided.

Constitutional.

Of *constitutional remedies* there is none so useful in the treatment of iritis *as mercury*. The drug should be given in some form or other, so as speedily to affect the system in all cases where inflammatory products are plentifully produced, whether the inflammation be of syphilitic origin or not. A pill containing gr. ij of Pil. Hydrarg. and gr. ¼ of Pulv. Opii may be taken three times a day; this is a very convenient and effectual mode of administration. Mercurial inunction, or vapour baths, may be employed if preferred.

If the iritis occur in debilitated states of the system, or the inflammation go on to suppuration, tonics, as iron or quinine, should be prescribed, and a plentiful supply of good food given. Should there be much pain opium must be given, and it is well to prescribe the drug in conjunction with extract of belladonna or hyoscyamus.

The results of iritis, should they seriously interfere with vision, require the performance of iridectomy or some one of the operations for artificial pupil. (*See* p. 352)

Injuries.

Injuries.—The iris may be cut, torn, or bruised; prolapsed through, or adherent to, the cornea, in cases of penetrating wounds of that structure (*see* Wounds of the Cornea); or it may be separated from its insertion to a greater or less extent by concussion, without external wound. Any of these injuries are liable to set up iritis, or may possibly be followed by suppuration.

Treatment.

TREATMENT.—The injured eye should be kept carefully bandaged with lint soaked in belladonna lotion, and if much pain is complained of, or other inflammatory symptoms arise, blood should be freely taken from the corresponding temple, either by leeches or the artificial leech.

As in iritis from other causes, the pupil may become blocked, or extensive synechiæ form, requiring operative interference at some later period. (*See* p. 352.)

Hyperæmia of choroid.

Hyperæmia of choroid.

Increased vascularity of the choroid is not unfrequently met with, more especially in myopic persons; it should be suspected if a feeling of fulness and tension of the eyes, accompanied by some watering and intolerance of light, be complained of.

On examination with the ophthalmoscope increased redness of the choroid (especially of that portion nearest the outer side of the optic disc) and some enlargement of the choroidal vessels can be made out; these changes will, however, be very probably overlooked by an inexperienced observer.

Treatment.

TREATMENT.—The eyes should be kept carefully at rest, protected from light, cold douches employed, and all positions (as stooping or hanging the head) which cause congestion of the eyeballs carefully avoided; blood may be taken from the temples, and if glasses have been worn their use must be discontinued.

Choroiditis.

Inflammation of the choroid, "Choroiditis," occurs under much the same conditions as iritis; two forms will be commonly met with—simple and syphilitic. Choroiditis also plays a prominent part in sympathetic ophthalmia, and is not unfrequently associated with inflammation of the iris—"choroido-iritis."

Choroido-iritis.

Symptoms.—In all cases of choroiditis more or less loss of transparency will be found. A diagnosis can only be made with certainty by examination with the ophthalmoscope. Pain, intolerance of light, impairment of vision, fulness of the veins emerging from the sclerotic in the ciliary region, ciliary redness, dilatation and sluggishness of the pupil, and increased tension of the globe, are symptoms often met with in choroiditis, but are by no means characteristic of it.

The changes seen in the choroid with the ophthalmoscope are, greyish or yellowish patches or spots of exudation surrounded by more or less redness (hyperæmia); at a later period patches of atrophy make their appearance. The exudation may occur in one or more large patches, or be distributed over the whole or greater part of the choroid in the form of spots, this latter condition being known as "choroiditis disseminata."

Choroiditis disseminata.

Syphilitic choroiditis.

Syphilitic choroiditis (in typical cases) is characterised by the existence of yellowish lymph-nodules similar to those met with in syphilitic iritis, but, as in the latter disease, typical cases are only occasionally met with, and we must be guided by the same rules in forming a diagnosis. (*See* p. 315.)

Choroiditis is frequently associated with inflammation and opacity of the vitreous humour; the retina covering the affected portion of choroid is usually involved in the inflammatory change, and the optic disc may be implicated if choroiditis exist in its vicinity.

Atrophy of choroid.

Atrophy of the choroid, as above stated, frequently follows on inflammation. The ophthalmoscope shows white or dirty white patches, or spots corresponding to the areas previously occupied by inflammatory exudation. The appearance is caused by destruction of the choroid, which allows the white sclerotic to show more or less plainly through it. The atrophic patches are frequently surrounded by dark borders, from accumulation of pigment which has been displaced by the inflammatory exudation.

Cyclitis.

Inflammation of the ciliary portion of the choroid (ciliary body) is known as "cyclitis."

Cyclitis is characterised by redness and swelling of some part or the whole of the ciliary region, with considerable enlargement of the veins of the retina, choroid, and iris, and pain in the eyeball, which is aggravated by pressure in the ciliary region. Cyclitis may be caused by injury or may depend upon syphilis, inherited or acquired. Softening and shrinking of the globe is very likely to follow from impairment of nutrition, dependent on interference with the circulation of blood. Suppuration may also take place. Wounds implicating the ciliary region of the sclerotic should always be looked upon as much more serious than those of other portions of the tunic, as cyclitis is frequently set up by such injuries. Cyclitis is not uncommonly associated with iritis—"irido-cyclitis."

Irido-cyclitis.

Treatment.

TREATMENT.—The treatment of choroiditis should be very similar to that of iritis. Iridectomy does good in some chronic cases or in those in which there is increase of tension of the globe. For the atrophic changes no treatment is of much avail.

Deposit of bone.

Bone upon the choroid.—Deposits of bone are not unfrequently met with upon the inner surface of the choroid in eyes that have been blind, and shrunken, for years.

Tubercle.

Tubercles in the choroid.—In cases of general tuberculosis deposits of tubercle have occasionally been met with in the choroid.

Injuries of choroid.

Injuries.—The choroid may be injured by foreign bodies entering the eyeball or ruptured by violence, without perforation of the tunics.

In the former case more especially (if a foreign body be lodged in the structure of the choroid) inflammation is very liable to follow, the eyeball being eventually lost by suppuration or shrinking. A rupture of the choroid from external violence is attended with more or less hæmorrhage, which fills the rent made in its structure with blood, and may cause considerable displacement of the retina.

Seen with the ophthalmoscope soon after the receipt of the injury, a rupture of the choroid appears as a more or less elongated blood clot; later the blood becomes absorbed and a white linear figure is left, from the white sclerotic showing through the rent in the choroid. This form of injury is not often followed by destructive inflammation.

Treatment.

TREATMENT.—Injuries of the choroid should be treated in the same manner as injuries of the sclerotic, cornea, or iris, with belladonna lotion, lint and a bandage.

Sympathetic Ophthalmia.

Sympathetic ophthalmia.

Sympathetic ophthalmia is the name applied to a peculiar form of inflammation of the choroid, ciliary body, and iris, coming on in one eye in consequence of morbid changes which have previously existed or are still in operation in the other.

Danger of wounds of ciliary region.

The most common causes of sympathetic ophthalmia are injuries of one eye, *especially wounds implicating the ciliary region*, or associated with *lodgment* of a foreign body in the interior of the globe.

Character of inflammation.

The wounded eye shortly after the receipt of an injury may become affected by choroido-iritis, the inflammation being of a *markedly adhesive character;* pain more or less severe is complained of, sight is rapidly lost; extensive synechiæ form; the tension of the globe, at first somewhat above par, diminishes, and shrinking of the eyeball follows.

At any time during the foregoing changes in the injured eye the sound one may become irritable and painful, and a similar inflammation may be set up in it, leading rapidly to a like result.

Treatment.

TREATMENT.—Where sympathetic ophthalmia has been once established, in all probability irreparable damage will be done; the great point to bear in mind is to prevent its occurrence by *timely extirpation of the damaged globe* (*see* Extirpation of the Eyeball). Should the disease have become fairly established, little benefit can be expected to result from extirpation, as the morbid changes will probably continue in the sympathetically inflamed globe, in spite of the removal of that primarily affected. Should the injured eyeball have been removed, the sympathetically affected one or (if excision have not been performed) both eyes should be kept carefully bandaged with lint soaked in belladonna lotion; pain must be relieved by the same methods as in cases of iritis. Any constitutional treatment that may appear necessary should be employed, and as soon as the more acute inflammatory symptoms have subsided iridectomy should be performed. The operation often exerts a very beneficial influence upon the nutrition of the globe (*see* Iridectomy). Should the new pupil become (as is very likely to be the case) occluded by inflammatory exudations, a second or even third operation should be tried. Should suppurative inflammation be set up in one eye, sympathetic changes need not be feared in the other; it is only in the adhesive form of choroido-iritis that sympathetic ophthalmia is likely to occur.

THE VITREOUS HUMOUR.

Opacity of vitreous.

Opacities in the vitreous are frequently met in cases of myopia, and are often the result of choroiditis.

Inflammation.

Inflammation of the vitreous is occasionally met with; it is generally of syphilitic origin or may be caused by injuries, especially the lodgment of foreign bodies within the globe. Vision becomes misty, and on examination the humour is found to be more or less turbid.

TREATMENT.—Should the inflammation be of syphilitic origin, anti-syphilitic remedies should be employed; should it depend on injury, the eye must be kept bandaged with lint soaked in belladonna lotion, and measures taken to subdue the inflammation.

Hæmorrhage.

Hæmorrhage into the vitreous.—Occasionally bleeding takes place into the vitreous humour to a considerable extent. Impairment of vision is complained of, and it will usually be stated that the loss of sight came on suddenly, and often during some exertion. Examination with the ophthalmoscope (direct method) shows the vitreous chamber to be occupied by a turbid irregular cloud which floats about as the eyeball is moved, gradually subsides to its lower part, when the movements are discontinued, and is stirred up again on the movements of the globe being repeated. The blood becomes absorbed to a greater or less extent in the course of time, but very commonly some permanent opacity is left.

Iridectomy appears to hasten the process of absorption.

GLAUCOMA.

By glaucoma we understand "A series of morbid changes of the eyeball; the most prominent of which, and apparently the one which causes all the others, being an increase of tension of the globe." (Bader.)

The cause of the increase of tension is unknown, but is supposed to result from undue accumulation of the intra-ocular fluids, dependent on hyper-secretion or deficient absorption. Glaucoma is said to be simple when the increase of tension progresses slowly and continuously without inflammatory outbreaks; *acute or chronic* when attended by attacks of inflammation.

Simple glaucoma.

Simple glaucoma presents no very marked symptoms, its onset being most insidious. It is characterised by gradual decrease of acuteness of vision, with narrowing of the visual field, impairment of the power of accommodation, causing rather rapid increase of presbyopia, sluggishness of movements of the iris, some apparent haziness of the lens, and some dilatation of the pupil. Increase of tension is probably one of the earliest symptoms, but is very liable to be overlooked until

Increase of tension.

the disease is far advanced and considerable hardness of the globe has taken place. With the ophthalmoscope spontaneous pulsation of the retinal arteries may be seen, or pulsation may be produced by very slight pressure upon the globe. The vessels, especially the veins, will be thinner on the surface of the optic disc than in the surrounding retina, and the disc itself may be more or less cupped. The cup of glaucoma is characterised by a bluish appearance of the greater portion of the disc, upon this blue portion the vessels appear very small and indistinct, or they may be quite invisible; the margin of the disc is white and the large tortuous retinal vessels are seen curling up over its edge, and appearing on the surface of the retina at a point not continuous with their course upon the nerve surface. Small hæmorrhages may also be met with upon the retina. Sooner or later, in any form of glaucoma, if relief be not given, the condition known as *absolute glaucòma* is established.

Spontaneous pulsation.

Cupping of disc.

The eyeball becomes stony hard, the pupil widely dilated and fixed, the cornea hazy and anæsthetic, the iris and aqueous humour discoloured, the anterior chamber shallow, and the lens more or less opaque. A few dilated veins will be seen issuing from the globe in the ciliary region, the sclerotic may be somewhat bulged in places and appear bluish in colour, and the conjunctiva will be found extremely rotten, tearing on any attempt being made to seize it with forceps. On examination with the ophthalmoscope all appears dark behind the pupil, or a dull red reflection may be returned from the interior, but no details of the fundus can be made out; all perception of light is lost.

Absolute glaucoma

Acute glaucoma usually commences suddenly with well-marked inflammatory symptoms. The patient will state that he was seized with sudden severe pain in the eye (frequently during the night); the pain will be described as affecting, not only the eyeball, but the whole of the corresponding side of the head, and he will have found that the sight of the painful eye is much impaired or entirely lost. On examination the eyelids will be found slightly reddened and swollen, the conjunctiva somewhat chemosed; there will be enlargement of its vessels, and also of those situated more deeply in the subconjunctival tissue. There may be profuse lachrymation, and often much intolerance of light; the aqueous humour will very probably be somewhat turbid.

Acute glaucoma.

The pupil will be dilated, somewhat irregular and fixed, and the tension of the globe increased. On examination with the ophthalmoscope some of the appearances mentioned under simple glaucoma may be found, but the media may be so hazy as to obscure the parts behind, a dull-red reflection being all that can be made out. The acute symptoms may pass off in the course of a few days or weeks, leaving the eye more or less permanently damaged. Similar attacks may recur, but more frequently the disease relapses into a chronic state.

Ophthalmoscopic appearances.

Chronic glaucoma is the form of the disease most commonly met with; it is characterised by the occurrence of slight inflammatory attacks, associated with temporary dimness of vision and more or less pain in and around the eyeball. On examination the tension of the globe will be found to be increased, and if the patient present himself during an inflammatory attack the conjunctiva and subconjunctival

Chronic glaucoma.

tissue will be found unduly vascular, the pupil will be somewhat dilated, and the movements of the iris sluggish.

Peculiar affection of vision.

The loss of vision, in cases of chronic glaucoma, is attended by somewhat peculiar symptoms. Patients complain that their sight is always somewhat misty, that there is an appearance of a bright halo around a candle or other flame, that they see colours resembling a rainbow and often of great beauty, and occasionally complaints are made of flashes of light and fiery circles; these latter symptoms are, however, common to all forms of retinal irritation. Vision is always worst during the inflammatory attacks and recovers to a certain extent during the remission, never, however, returning to the same condition as before the attack.

The ophthalmoscope shows changes similar to those mentioned under simple glaucoma.

Glaucoma fulminans.

There is yet another form of glaucoma requiring mention; it is, fortunately, rarely met with. Its principal characteristic is the extreme suddenness and violence of its onset; its symptoms resemble those of acute glaucoma in an aggravated form. This variety of glaucoma is known as *glaucoma fulminans,* and the eye attacked by it may be entirely lost in the course of a few hours. The attack may occasionally be accompanied by severe headache and vomiting.

Glaucoma is essentially a disease of commencing old age, occurring most frequently between the ages of fifty and sixty, but occasionally cases are met with in young adults, or even in children. Glaucoma almost always affects both eyes, not, however, simultaneously, but at more or less considerable intervals.

Diagnosis of glaucoma.

In order to diagnose glaucoma we must be well acquainted with the method of ascertaining the tension of the globe, and also with the use of the ophthalmoscope. (*See* pp. 294, 288, *et seq.*)

We must also remember that the injurious effects of pressure are evidenced earliest in the peripheral portions of the retina; we must therefore very carefully examine the condition of the *visual field* in all suspected cases. (*See* p. 297.)

Contraction of visual field.

Cases will frequently be met with in which great contraction of the visual field has taken place, although central vision may still be acute.

Rapid increase of presbyopia.

Another symptom which should lead us to suspect glaucoma is the *rapid increase of presbyopia.* Patients affected by the simple or chronic forms of the disease are constantly changing their glasses, as they find that those which at first appear to suit become useless in the course of a few months.

Apparent haziness of lens.

Apparent haziness of the crystalline lens is a symptom requiring special attention; otherwise the Surgeon may fall into the fatal error of mistaking chronic or simple glaucoma for cataract, and allow the disease to continue until sight is irrevocably lost. Ophthalmoscopic examination will most probably show that there is little or no real opacity of the lens; this, aided by a careful examination of the tension of the globe and the state of the visual field, should guard us against making so disastrous a mistake.

Treatment.

TREATMENT.—Glaucoma can be remedied *by operation alone.* And it is our duty to explain to the patient the nature of his case and to urge upon him most strongly the *necessity* for operative interference.

Patients suffering from glaucoma often evince the greatest unwillingness to undergo an operation; this unwillingness is explained by the fact that during the *remissions* of glaucoma little or no inconvenience is experienced, and, moreover, even at the time that an attack of inflammation is present the sufferer will be encouraged by the hope that the symptoms will pass off (as they in all probability have done in previous attacks), leaving the eye but little damaged. Nevertheless we must always bear in mind *that an operation, to be successful, must be performed early,* and must not be satisfied until we have convinced our patient of this. Most patients will readily submit to an operation when one eye has been lost and the disease has commenced in the other. Several operations have been practised for the relief of glaucoma, but iridectomy is that which gives the best results, and is almost universally practised at the present day.

Iridectomy.

Iridectomy, to be effectual, should be performed as early as possible; as a rule, no good is likely to result from the operation in cases where vision has been reduced to bare perception of light; but in acute glaucoma much improvement may take place even though all perception of light have been lost for some days.

In performing iridectomy for glaucoma we must take care to remove the iris well down to its insertion and to excise a good broad piece (*see* p. 350); merely cutting away a portion of the iris near the margin of the pupil does no good. The operation is easy enough of performance in cases of acute glaucoma, but in those of old standing the structures become so rotten as to render iridectomy anything but an easy procedure.

Medical treatment.

In cases of glaucoma where for any reason an operation does not seem advisable we must do our best to give relief by medical treatment. The means which will be found most useful are the application of sedative fomentations, administration of opium, and the local abstraction of blood by leeches or the artificial leech.

Atropine.

Atropine *should not be used* in glaucoma, as it causes increased vascularity of the globe, and with it augmentation of tension. Its application is recommended in most works on ophthalmic subjects, but it would appear to do more harm than good.

THE RETINA AND OPTIC NERVE.

Vision.

Vision.—Space will not allow of a detailed account of all the anomalies of vision which may be met with. Before the introduction of the ophthalmoscope all cases of *want of sight* occurring without cause apparent to the unaided eye were collected together into two classes bearing the names of "amblyopia and amaurosis."

Amblyopia and amaurosis.

To the former were referred all cases where vision was much impaired but not entirely lost, to the latter cases in which not even perception of light remained. But now that the ophthalmoscope has come so generally into use, making the interior of the globe as accessible to our sight as the exterior, we have come to refer "amplyopia and amaurosis" to their proper causes, and the terms have fallen into comparative disuse. For instance, if in a case of want of sight we find on ophthalmoscopic examination that there is haziness of the vitreous, inflammation of the retina, &c., we do not say (as formerly) that the patient is "amblyopic," but that he is suffering from opacity of the vitreous, retinitis, &c. Again, in cases of total blindness, the ophthalmoscope will in all probability detect atrophy of the optic nerve or other lesion, and instead of saying that the patient is "amaurotic" we say that he is suffering from atrophy of the optic nerve, &c. The terms "amblyopia and amaurosis" may, however, still be used in some rare cases where there is partial or complete loss of sight, associated with an apparently healthy condition of all the ocular structures.

Hyperæmia of retina.

Hyperæmia of the retina occurs from over-strain of the eyes, in doing near work (especially in hypermetropic persons), or from constantly looking at bright light; the disease is not uncommon amongst engine-drivers and others who work over a blazing fire.

The patient complains of some dimness of vision, and a feeling of fulness and discomfort in the eyes. On examination with the ophthalmoscope the retinal vessels, both arteries and veins, will be found increased in size, and a greater number of each will be visible than in the healthy retina.

Active and passive hyperæmia.

This form of hyperæmia may be described as "active;" another form of hyperæmia, affecting only the retinal veins, which become enlarged, tortuous, and sometimes varicose, may be described as "passive;" the condition is indicative of obstruction to the return of blood from the eyeball. (*See* Ischæmia.)

Hyperæmia of the retina, especially the active form, is not easily recognised, as the limits between health and disease fade almost imperceptibly into each other, and considerable experience is required in order to judge with certainty where one ends and the other begins.

Treatment.

Treatment.—Active hyperæmia should be treated by rest, careful shielding of the eyes from bright light by means of blue protectors or a shade, and (after the subsidence of the hyperæmia) any anomaly of refraction should be carefully neutralized.

Retinitis.

Passive hyperæmia is usually an indication of some more serious disease, and requires no special treatment.

Inflammation of the retina (retinitis).—*Causes.*—Retinitis most frequently depends on some constitutional condition, as albuminuria, syphilis, or leucocythæmia; it may also arise from embolism of the retinal vessels, hæmorrhage into its substance, or from cerebral disease; be secondary to choroiditis, iritis, and cyclitis; be set up by tumours or entozoa within the globe, or be caused by injury from exposure to sudden flashes of bright light or in consequence of wounds of the eyeball.

Retinitis is characterised by hyperæmia of the retina, associated with more or less dense and extensive opacity of its structure, and frequently with extravasations of blood in its internal layers.

Affection of vision.

Disturbance of vision may be a prominent symptom, or the patient may hardly be aware that anything is amiss with his eyes. The degree of impairment of vision depends upon the situation and extent of the inflamed portion of the retina; for instance, a small patch of inflammatory exudation in the region of the yellow spot will cause much loss of sight, whereas a considerable amount of opacity situated peripherally will give rise to scarcely any symptoms.

Pain, intolerance of light, coloured vision, and flashes of light, are all symptoms occasionally met with in inflammation of the retina.

Acute retinitis is rarely met with, and if it should occur would hardly be recognised, as the inflammatory exudation would be transparent, and, therefore, invisible; consequently the only appearance revealed by the ophthalmoscope would be enlargement and tortuosity of the retinal vessels, more especially of the venous trunks.

The forms of retinitis which give rise to striking ophthalmoscopic appearances are essentially of a chronic nature, and are frequently associated with inflammatory changes in the choroid and optic nerve. Several varieties of retinitis are described.

Retinitis may affect one or both eyes, those forms which are of constitutional origin usually affecting both, though not always in the same degree.

Simple retinitis.

Simple retinitis.—The ophthalmoscope shows a more or less general turbidity of the retina, varying from a scarcely perceptible cloudiness (giving the idea that the structure is coloured and visible instead of entirely transparent) to a uniform greyish-white or mottled opacity, which appears to cover the choroid like a veil.

The outline of the optic disc will be indistinct, and its colour, especially at its margins, somewhat altered. The retinal veins will appear enlarged, dark coloured, evidently gorged with blood, often twisted in their course, and they may be in parts hidden by the inflammatory exudation. The condition of the arteries will be nearly normal, or they may appear too thin.

Small hæmorrhages may frequently be detected in the course of the distended veins.

Hæmorrhagic retinitis.

Hæmorrhagic retinitis.—The optic nerve will be found reddened, somewhat swollen, its outline obliterated, its transparency so much affected that the course of the retinal vessels upon its surface and in its substance cannot be traced; the retinal veins will be turgid, and tortuous in their course, presenting alternately light and dark portions, according as they lie deeply in the engorged retina or more superficially near its inner surface. The retinal arteries, as in the simple form of retinitis, will be nearly normal or too thin.

Peculiarity of blood extravasations.

The principal characteristic of the disease is the occurrence of extensive hæmorrhage, most marked around the optic disc, and fading away gradually into the surrounding parts. The blood-extravasations have a peculiar striated appearance, and radiate, spoke-like, from the optic disc as a centre. In some cases the retina immediately surrounding the disc may be uniformly soaked with blood, the bright red colour thus produced gradually shading off externally into the spoke-like appearance above mentioned.

As time goes on the extravasated blood undergoes changes, becoming brown in colour, and partially absorbed.

Retinitis pigmentosa.

Retinitis pigmentosa is a peculiar form of degeneration of the retina, met with most frequently in the offspring of blood relations; the sufferers are often deaf and dumb, and may be partially idiotic.

Night blindness.

The most marked symptoms of the disease are *night blindness* and *gradual narrowing of the visual field without glaucomatous symptoms*. The ophthalmoscope reveals the most striking changes; the retina, more especially its peripheral parts, is found to be dotted more or less thickly with black pigment spots; these spots appear somewhat like a multitude of small black spiders with many legs; they have also been likened to bone-corpuscles. The spots of pigment appear to follow the course of the blood-vessels of the retina, and, as before stated, are collected most thickly in its peripheral parts.

The blood-vessels themselves will be much diminished in size and visible number, and the optic disc markedly anæmic.

Albuminuric retinitis.

Albuminuric retinitis is a peculiar form of retinitis met with in Bright's disease. The changes which take place in the retina are inflammation with effusion and hæmorrhages, followed by fatty and fibrinous degeneration of its structure, and subsequent atrophy.

The ophthalmoscope shows, in the early stages of the disease, retinal hyperæmia (more especially venous) with increased vascularity and redness of the optic disc. Next the retina becomes cloudy (more especially around the optic disc, the outline of which becomes obscured), and numerous hæmorrhages in the form of streaks and spots occur in various parts of its structure.

Characteristic appearances.

The cloudiness goes on increasing and obscures the smaller vessels; next, in different parts of the fundus, but mostly in a ring situated at a little distance from the margin of the disc, appear glistening white spots and patches, which by their coalescence eventually form a broad white band, which partially or entirely surrounds the now grey opaque optic disc, being separated from it by a grey opaque portion of retina. These appearances are entirely characteristic of albuminuric retinitis.

Changes in yellow spot.

Whilst the above changes are going on in other parts of the retina, characteristic appearances may be developed in the region of the yellow spot. A number of small white glistening spots, which, however, do not coalesce so as to form a band, but remain distinct, make their appearance. These glistening spots are arranged in a somewhat radiated position around the macula as a centre, and somewhat resemble a constellation; the appearance is quite characteristic, and once seen is not likely to be forgotten.

As the opacity of the retina increases, the vessels become more and more obscured, so that when the disease has reached its height only a few large venous trunks are still visible. Fresh hæmorrhages may occur at any time, and cover over and obscure the opaque portions of retina. After a time a retrograde process sets in, the hæmorrhages and peculiar opacity slowly disappear, the retina being at length left in a state of atrophy.

Leucæmic retinitis.

Leucæmic retinitis.—A peculiar form of retinitis somewhat resembling the albuminuric has been described as occurring in connection with leucocythæmia.

Leucæmic retinitis is marked by pallor of the optic disc, a peculiar rose colour of the retinal vessels, hæmorrhages, some opacity of the retina around the optic disc, and white glistening spots similar to those met with in albuminuric retinitis, which, however, are situated in the peripheral parts of the retina.

Embolism of retina.

Embolism of the retina.—A form of retinitis is found associated with plugging of the central artery. The symptoms are sudden and complete loss of sight, coming on without apparent cause. Ophthalmoscopic examination shows some pallor of the optic disc and diminution in calibre of the vessels emerging from it, but the most marked change is seen in the region of the yellow spot.

Changes about yellow spot.

The retina around the spot will be grey and opaque, and numerous blood-vessels not visible under ordinary conditions will have come plainly into view; the macula itself will be seen as a bright red spot (which might be taken for a hæmorrhage by a careless observer) situated in the centre of the opaque portion of retina.

The bright red appearance of the macula arises from the anatomical arrangement of the parts; the retina in this portion, being thin and firmly bound down to the parts beneath, does not become infiltrated with inflammatory exudation, and consequently the normal red colour of the fundus appears in striking contrast to the surrounding opaque retina.

Syphilitic retinitis.

Syphilitic retinitis.—A form of inflammation affecting the retina immediately surrounding the optic disc has been looked upon by some as of syphilitic origin, but, like syphilitic iritis, rarely presents any very characteristic signs. Should retinitis occur with other manifestations of syphilis, congenital or acquired, it may be looked upon as syphilitic.

Treatment of retinitis.

TREATMENT.—Both eyes should be kept thoroughly at rest, by prohibiting all near work, paralysing the accommodation by the use of atropine, and shielding the eyes from the stimulus of too bright light by means of blue protectors. Everything that is likely to cause disturbance of the ocular circulation, as stooping positions, excitement, stimulants, too rapid variations of temperature, &c., must be carefully avoided.

Abstraction of blood. Mercury.

In simple retinitis blood should be taken from the temples by leeches, or preferably by the application of the artificial leech. In some cases mercury does good, and if the drug be used it should be given either by the mouth, by inunction, or in the form of vapour baths, so as quickly to affect the system. In cases of long standing, however, small doses of the bichloride of mercury, taken regularly for some months, may be beneficial. Mercury does most good in simple retinitis, and in retinitis connected with syphilis. The other forms of retinitis are of only secondary importance to the disease with which they are associated, and against which treatment must be directed (*see* Causes of Retinitis). No treatment is of much avail in retinitis pigmentosa.

Atrophy of retina.

Atrophy of the retina is the sequel of inflammatory changes. Its principal characteristic seen with the ophthalmoscope is a condition of bloodlessness, in some cases associated with opacity of its structure, and frequently with atrophic changes in the choroid. Bloodlessness shows itself in diminution of the visible number and also of the calibre of the retinal blood-vessels, more especially of the arteries; some of these may appear to be pervious to red blood-corpuscles only in part of their course, their continuations being marked by a yellowish white cord. Opacities, if they occur, are of a greyish-white colour, and situated for the most part around the optic disc.

Condition of optic disc.

The disc itself is frequently extremely anæmic or atrophied. (For treatment of atrophy of the retina, *see* Atrophy of the Optic Disc).

Hæmorrhage into the retina.

Hæmorrhage into the retina.—Besides the form of hæmorrhage described as occurring in retinitis, bleeding may take place into the structure of the retina, from rupture of a retinal blood-vessel without previous inflammatory change. The hæmorrhage is usually considerable, and will be seen as an irregular patch of blood, situated somewhere in the course of the vessel by the rupture of which it has been allowed to escape. The hæmorrhage may be surrounded by inflammatory exudation.

As time goes on the blood clot may be absorbed, but will usually leave behind it some indications of its previous existence.

TREATMENT.—Rest of the eyes and protection from bright light.

Displacement of retina.

Displacement of the Retina is caused by effusion of serous fluid between it and the choroid; it not unfrequently results from blows on the eyeball or the head in its vicinity, and is often met with in myopic eyes. The displacement may vary in extent from detachment of a small fold to total separation of the whole retina from the choroid, the only points of attachment left being at the optic disc and ciliary processes. Displacement of the retina occurs by preference at its lower part.

The ophthalmoscope shews a grey, opaque, movable cloud, over the surface of which the retinal blood-vessels can be traced.

Treatment.

Treatment.—Little can be done to remedy displacement of the retina, but an attempt should be made to procure absorption of the fluid by the administration of such drugs as iodide of potassium and mercury, and by the application of blisters to the temple. If the displacement occur in connection with myopia the anomaly of refraction should be carefully neutralized by suitable glasses; and in all cases rest should be insured to the eyes, so as to prevent as much as possible further detachment.

Optic neuritis.

Inflammation of the optic disc (optic neuritis, neuro-retinitis) occurs as the result of irritation of the trunk of the nerve in some part of its course external to the eyeball; the inflammatory change extending downwards along the nerve and finally affecting its intra-ocular portion, hence it is sometimes described as "descending neuritis." The ophthalmoscope shows a reddish-grey turbidity of the disc and a zone of surrounding retina, accompanied by swelling of the parts. The retinal veins are engorged, but their visible number is not increased; the arteries are thinner than usual, and all the vessels are more or less shrouded and concealed from view in the opaque portion of retina and upon the nerve surface. Numerous small hæmorrhages may occur upon the disc and around it.

Vision is always considerably affected in *optic neuritis.*

Choked disc.

Ischæmia of the disc (choked disc).—Choking of the optic disc is met with in a large majority of cases of cerebral tumour, or other affections within the cranium which cause obstruction to the return of venous blood from the eyeball. The condition known as choked disc is frequently confounded with optic neuritis, from which, however, it differs in some essential particulars. In choked disc the intra-ocular portion of the nerve alone is affected. The ophthalmoscope will show great swelling and an intense red colour of the disc, its outline being entirely lost; there is, however, but slight swelling or opacity of the surrounding retina; small hæmorrhages are frequently seen on the nerve surface. The retinal veins will be enormously distended, their course extremely tortuous, and they may be varicose; their visible number will also be considerably increased. The arteries will be thinner than natural or of normal calibre; none of the vessels are shrouded and concealed from view, as in neuritis. In by far the greater number of cases of ischæmia of the disc vision is unaffected. Ischæmia may go on to neuritis.

Treatment.—Optic neuritis and ischæmia of the discs are of only secondary importance to the disease which gives rise to them; they are of much more interest to the physician than to the oculist, as their existence enables him to diagnose cerebral lesion with great certainty.

Generally speaking, optic neuritis commencing as such may be looked upon as indicative of irritation of the nerves in some part of their course.

Ischæmia means simply obstruction to the venous circulation, and may result from pressure directly on the main trunks, or from any form of disease whatever which shall cause *over-crowding* of the contents of the cranium. Both neuritis and ischæmia are usually bilateral.

Atrophy of optic nerves.

Atrophy of the optic nerve is usually the result of preceding neuritis, but occasionally cases are met with where the atrophy seems to have commenced as such, and to have slowly progressed without inflammatory change.

Atrophic cup.

With the ophthalmoscope the optic disc will be seen to be white or bluish white in colour, frequently its margin appears irregular, and it may be cupped. The atrophic cup varies from the glaucomatous in not having steep sides, so that the vessels do not appear broken in their course as in the latter affection; the atrophic cup does not take in the whole nerve, but only its central part, which slopes gradually backwards; the vessels appear curved on the surface of the disc, but are not altered in calibre as in glaucoma. Atrophy of the retina frequently goes along with atrophy of the optic disc.

State of vision.

In cases of atrophy of the optic nerves vision is always much impaired; some patients with extremely white discs can count fingers or even distinguish large letters, but in the majority of cases vision is reduced to bare perception of light.

Treatment.

TREATMENT.—The treatment of atrophy of the optic nerves, especially if associated with a similar condition of the retina, is most unsatisfactory, and, indeed, almost hopeless. If a certain amount of vision still remain, and no change have taken place for many months, we may safely assure our patient that he will retain what sight he has. The drugs which have been principally used are iron, either alone or in combination with nux vomica, strychnia taken by the mouth or injected hypodermically, phosphorus, quinine, or other tonics, and opium in gradually increasing doses. Galvanism has also been employed.

OPERATIONS ON THE EYEBALL AND ITS APPENDAGES.

POSITION OF PATIENT AND OPERATOR, &c.

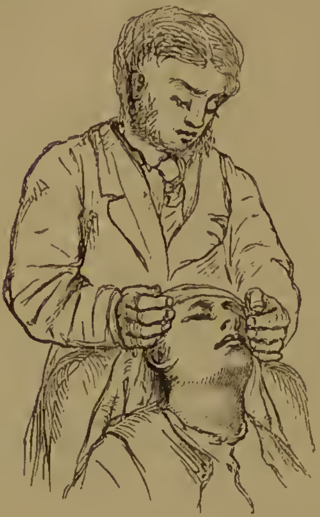
Operations.

All the minor operations, such as slitting the canaliculi, passing probes down the nasal duct, opening tarsal cysts, &c., can best be performed when the patient is seated in a chair, and the operator stands behind him; the patient's head, over which a towel has first been thrown, resting against the operator's chest. (*See* Fig. 82.)

The more important operations, as extraction of cataract, iridectomy squint, &c., should be performed whilst the patient is lying on a hard couch, his head resting on a bolster covered by a towel, which should be thrown forward over the forehead; the operator should sit or stand behind (*see* Fig. 83). In whichever position an operation is to be performed, the chair or table should be placed in front of a large window

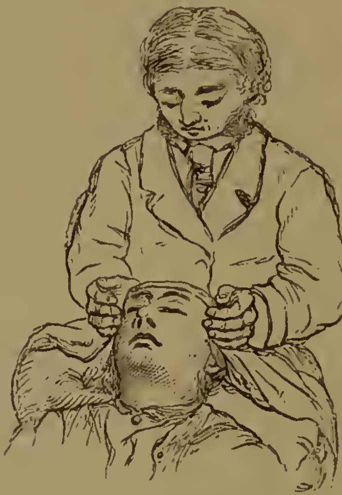
Position of patient and operator.

FIG. 82.



Position for minor operations. (Sitting.)

FIG. 83.



Position for major operations. (Lying.)

Importance of good light.

so as to insure a good light, and care be taken to prevent assistants and others from interposing their heads or bodies between the patient's face and the source of light. It will be found whilst operating that, with the exception of occasional pronation and supination, there is little occasion to use the arms, which should be kept with the elbows near the sides, whilst the wrists rest on the patient's head or face, in a convenient position, which allows of free movements of the hands and fingers.

Every ophthalmic Surgeon should, if possible, become ambidextrous; should learn to use his fingers and cultivate his sense of touch.

Incisions.

It will be found that incisions can be best made by holding the knife lightly between the thumb and first two fingers of whichever hand may be most conveniently situated.

In all operations incisions commencing at or situated entirely on the outer aspect of the globe should be made with the hand corresponding to that side, the opposite hand being employed upon the inner side. That is to say, if the right eye is operated on, the right hand should be used to make an incision at its outer side, the left at its inner, and *vice versâ*.

Incisions above or below may be made with either hand; scissors should also be used with whichever hand is most favorably situated.

In one operation, that[for internal strabismus, the positions of patient and operator are somewhat different from those already described, the operator standing in front, at the side of the couch on the patient's right, instead of behind his head.

The scissors may be used with the right hand for both eyes, but in operating on the left the hands will have to be crossed.

Condition of instruments.

Before performing any operation the operator should look carefully to the condition of the instruments he is about to use. Knives should be passed through a piece of thin leather tightly stretched on a small metal cylinder, and care taken to ascertain that they have good points and that there are no notches in the blades.

Scissors should be carefully examined and tried; it should be seen that forceps close perfectly and are free from rust or dirt; silk for sutures should be black, as fine and strong as possible, well waxed, and free from flaws or kinks. Inattention to these details may very possibly mar the success of an operation.

Use of anæsthetics.

Administration of anæsthetics.—The operator will find that he has much more command over the eye when the patient is under the influence of an anæsthetic than when consciousness remains, and in by far the greater number of cases he will do well to administer one.

Occasionally, patients are met with who will bear operations most quietly; such should be operated on without anæsthesia; but if during the operation the patient should become unsteady, or begin to strain, it is best not to risk failure, but to discontinue the operation and administer an anæsthetic. If the globe have been opened, it must be carefully guarded by a pad and bandage during the administration. If no anæsthetic be employed, the operation should be performed as simply and quickly as possible; no speculum should be used, nor should the eye be fixed with forceps, but the operator should keep the lids open, and steady the globe with his fingers.

After-treatment.

AFTER-TREATMENT.—Operations on the tear passages, removal of tarsal cysts and strabismus, require little or no after-treatment; the parts need only to be washed twice or three times a day with tepid water.

After more severe operations on the eyelids, and all cases where an incision has been made into the globe, the eye should be carefully covered with two small folds of lint, wetted with cold water, and secured by a single turn of bandage; the lint being kept wet and the eye bound up until the incision has healed and all irritation subsided. Wounds of the globe made in operations, as a rule, heal readily, union having frequently taken place at the end of twelve hours.

The great danger after operations on the globe is the occurrence of inflammation.

Occurrence of inflammation.

Inflammation, once set up, may subside shortly, leaving no trace behind it; it may continue until more or less irreparable damage has been done, or may run on into suppuration of portions or the whole of the globe, the cornea being more liable to this change than any other structure.

Time of onset.

The symptoms of inflammation usually appear within the two days immediately succeeding an operation, and little fear need be entertained for the safety of the eyeball if all have gone well for a week.

Occasionally, after cataract extraction, eyes have been lost through inflammation, or suppuration commencing at a later period, but these cases are rare and probably it will be found that some damage has been done to the eye shortly before the symptoms appeared.

Treatment of inflammation.

The treatment of inflammatory changes consists in the local abstraction of blood from the temple by leeches, or the application of the artificial leech; the use of fomentations of water, poppy-heads, or belladonna constantly applied; the administration of opium in full doses, either alone or combined with mercury. The treatment must, of course, be varied according to the condition of the patient; should he be weakly and anæmic, we should be careful about bloodletting, and instead quinine and iron, with good living and a fair amount of stimulants, should be prescribed.

The local abstraction of blood, however, acts most beneficially in relieving pain, and should therefore be employed in cases where pain is a prominent symptom, even though the patient may not appear to have much blood to lose. Strong healthy patients should be leeched freely, and kept on light diet.

During the treatment the eye must be kept carefully closed and bandaged, excepting during the time that fomentations are being applied. Moderate pressure by carefully applied pads of lint and cotton wool, secured by a few turns of flannel bandage, is said to exert considerable influence in cases where the cornea is threatened by suppuration; it should have a fair trial, if pressure can be borne.

If the inflammation go on to suppuration of the whole globe the case must be treated in the same manner as abscess in any other part. (*See* Ophthalmitis.)

Insertion of seton.

Insertion of a seton in the temple.—In order to place a seton in the temple, the position of patient and operator should be as in Fig. 82, p. 330. The operator should pinch up the skin with the finger and thumb of one hand, just in front of the patient's ear, and pass a seton needle armed with a double thread of stout silk through the fold thus produced; the silk should be drawn through and tied in a short loop. The seton should pass for about 1½ in. beneath the skin and should be placed amongst the hair, so as to avoid as much as possible disfigurement from the subsequent cicatrix; the silk should be drawn backwards and forwards through the wound every morning; it may be left in as long as appears necessary.

Wound of temporal artery.

Care must be taken in passing the needle not to wound the temporal artery; should this accident happen the seton must be removed and firm pressure applied with a pad and bandage.

Artificial leech.

Application of the artificial leech.—This instrument consists of a small sharp steel cylinder (worked by a spring arrangement), with which a circular incision can be made through the skin of the temple, and a hollow glass cylinder, which can be placed over the wound, and the air in its interior exhausted by means of a piston worked by a screw; as the air is removed, the blood flows up to fill the vacuum. Care must be taken not to work the screw too quickly, but only to move the piston at the same rate as the blood flows; neither must the edge of the cylinder be allowed to compress the skin against the parts beneath, otherwise the flow of blood will be impeded.

THE EYELIDS.

Molluscum.

Tumours.—Various small growths are met with about the eyelids. **Molluscum** occurs as a small yellowish-white projection, having a depressed centre, situated on some part of the skin of the lids; there may be only one or many of these little growths. They can be easily removed by thrusting a knife through them, the contents being then squeezed out with the thumb-nails.

Congenital sebaceous cyst.

A sebaceous tumour is not unfrequently met with situated deeply beneath the skin and muscle, often near the outer angle of the orbit. The tumour is congenital and filled with sebaceous matter, often mixed with hair. It must be carefully dissected out, much more trouble being experienced in so doing than would be at first suspected; the little tumour will be found attached deeply to the periosteum, and may have caused a depression in the bone; it will in all probability be opened during its removal.

Warts.

Warts are not unfrequently met with about the eyelids; they should be cut off with scissors.

Tarsal cyst.

Tarsal cyst is met with as a dusky red or colourless projection from the outer surface of the lid; its position is marked on the conjunctival surface by a bluish spot, from which a granulation is occasionally seen growing. The cyst is formed by obstruction of a Meibomian gland and retention of its secretion; it is sometimes in a suppurating condition.

The lid should be everted, the cyst freely opened from the conjunctival surface with a small knife, and its contents squeezed or scooped out; it must be thoroughly emptied, or it will, in all probability, re-form.

Filling of cavity with blood.

The cavity left on removal of the contents of the cyst will always fill with blood, and shortly after the operation the tumour will be as large or larger than before; the patient must be warned of this.

The swelling will most probably disappear in the course of from four to six weeks; if it remain longer the operation should be repeated.

Chalazion.

A tarsal cyst sometimes degenerates into a hard fibrous little mass, feeling somewhat like a large shot beneath the skin, which is known as a *chalazion.*

An incision should be made in the skin of the lid over the little tumour, which should then be carefully dissected out, the wound in the skin being afterwards closed by a fine suture.

Trichiasis.

Trichiasis signifies a faulty direction of the eyelashes, which turn inwards and irritate the cornea; it is usually caused by contraction of the conjunctiva (following granular ophthalmia or its unskilful treatment), producing distortion of the tarsal cartilage.

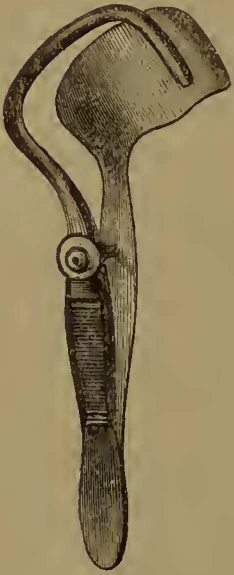
Only a few lashes may be misdirected, or the whole row may be inverted. If only a few of the lashes turn inwards, it is sufficient to pull them out with forceps whenever they become troublesome. If a considerable number or the whole row are inverted, their roots should be removed by operation. The operation should be performed as follows:—The patient being placed in the usual position (*see* Fig. 83, p. 330), the lid should be secured by a compressorium forceps (Figs. 84, 85), by which means it is steadied and hæmorrhage prevented (care must be taken not to screw the instrument up too tightly, or sloughing of the lid may follow). The lid being well secured, the operator should make an incision through the skin, about three lines from the free margin of the lid and parallel with it, of such a length as to correspond to the lashes which are misplaced; the incision should be carried down to the outer surface of the tarsal cartilage; a second incision should then be made of the same length as the first, in the

Operation.

margin of the lid, and so conducted as to split the lid and separate the skin and hair-bulbs from the subjacent structures; the ends of

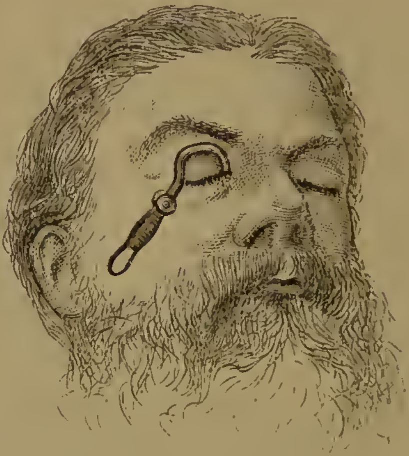
Compressorium forceps.

Fig. 84.



Compressorium forceps.

Fig. 85.



Compressorium forceps applied.

the two incisions should then be joined by two short cuts, and the portion of skin included with the hair bulbs dissected off the tarsal cartilage. The raw surface should then be wiped with a sponge, and any black dots denoting the presence of hair-bulbs carefully removed. The compressorium forceps should then be unscrewed, when sharpish hæmorrhage will take place. The eye must be covered by two pieces of wet lint secured by a turn of bandage.

Entropion.

Entropion signifies a rolling inwards of the whole lid, the whole row of lashes being completely turned towards the eyeball; it is most frequently met with in the lower lid, more especially of old people with a superabundance of loose skin about the face. It is often the cause of much trouble and annoyance, as well as of danger to the eye, after cataract extraction.

The inversion may be caused either by spasmodic contraction of the orbicularis muscle or, like trichiasis, by distortion and thickening of the tarsal cartilage, following granular ophthalmia.

From spasmodic contraction of orbicularis.

If entropion be caused by contraction of the orbicularis, it is easily remedied as follows:—The patient, lying on a couch (*see* Fig. 83, p. 330), the operator should seize with forceps the skin of the lid at a point near one or other canthus, and at a distance of about two lines from its margin, and then with scissors remove a portion in breadth corresponding to about half the surface of the lid, and extending along its whole length; he should then seize and remove the orbicularis muscle to a corresponding extent; no suture need be used; the eye should be bound up with wet lint and a bandage. The subsequent healing of the wound and contraction of the cicatrix will remedy the inversion.

From distortion of tarsal cartilage.

Entropion depending on distortion and thickening of the tarsal cartilage is usually met with in the upper lid. It can be remedied by removal of a wedge-shaped piece of cartilage, including the more thickened portion. The operation can be thus performed:—The patient, being in the usual position (*see* Fig. 83, p. 330), and the lid fixed by a compressorium forceps, with a sharp knife an incision should be carried through its whole thickness, parallel with and about two lines distant from its margin, the incision extending along the whole extent of the distorted portion. A somewhat lunated incision should then be carried from one end of the first around the base of the thickened portion of tarsus joining the first incision at its other extremity; the second incision should not be carried vertically through the cartilage, but slanting, so as to meet the first at the conjunctival surface; the portion of cartilage included by these incisions should then be removed. The skin and muscle covering the cartilage may be removed or not, according to the fancy of the Surgeon. If their removal be not desired, they should be dissected back before making the second incision. The wound should be closed by sutures. After the operation the margin of the lid should appear rightly directed. The eye should be bound up with lint and a bandage.

Ectropion.

Ectropion signifies an everted condition of the lid; the extent of eversion varies in different cases, from slight falling away of the margin of the lid from the globe to eversion of the whole extent of the lid and adjoining fornix of the conjunctiva.

From distension.

The slighter forms are caused by distension of the lid from inflammatory swelling, and are easily remedied by slightly narrowing the palpebral aperture, by paring the edges of the lids near the outer canthus, and bringing the raw surfaces together by means of a suture, when firm union will take place between the two.

From contraction of cicatrices.

The more extreme forms are caused by the contraction of cicatrices of burns, wounds, or inflammatory changes, about the orbit.

No definite rules can be laid down with regard to the treatment of these cases. The Surgeon must be guided by the conditions as they present themselves, and do the best he can.

In any case, if the tarsal cartilage be left entire, it must be carefully dissected away from its attachments and replaced as nearly as possible in its normal position. It must be kept in place by paring its margin and that of the opposite lid, and securing extensive and firm union between them by careful co-aptation of their raw surfaces. The lids must not be opened until all further contraction of the original cicatrix is at an end, and it is better to leave the eye closed for considerably too long a period than to open it a day too soon. Ectropion is also frequently seen in the more severe forms of ophthalmia or in cases of severe intolerance of light, and is specially liable to occur when an attempt is made to open a firmly closed eye. In these cases the eversion requires no special treatment, but disappears as the affection causing it is recovered from.

From photophobia.

Formation of new lid.

Formation of a new eyelid.—In some cases of burn, or from ulceration of a lupoid character, more or less complete destruction of the eyelids may take place. A flap of skin from a neighbouring part may

Preservation of tarsal cartilage.

be brought and placed in the gap, and there secured by means of sutures. Care should be always taken that the piece of skin is considerably larger than the surface it is intended to cover. Before removing any skin, search must be made in any portion of the eyelid that may be left for the tarsal cartilage. Should this be found it must be carefully dissected out and preserved, its natural form being as much as possible restored; it should be fixed in its proper position by uniting its margin to that of the opposite lid. It will in time become covered with cuticle, and form a very effectual covering to the eyeball.

Symblepharon.

Symblepharon signifies adhesion of the conjunctiva of the eyelid to that of the globe. It is usually caused by burns with lime or hot metal. The adhesion may occur to any extent, varying from a thin band of union to complete fusion of the whole lid with the globe.

Bands of adhesion.

The condition requires to be remedied by operation. In cases where only a thin band of adhesion exists this should be first carefully secured by a suture passed through it at the extremity nearest the eyeball; the band should then be divided, and drawn into the fornix by passing the suture through the lid and securing it to a small roll of strapping, placed upon the cutaneous surface. By this means the raw surface left by removal of the band from the globe is brought into contact with healthy conjunctiva and granulates over, healing without forming adhesions.

Extensive adhesions.

If more than one band exist, each should be dealt with separately.

Cases of more extensive adhesion give rise to the utmost difficulty in treatment, and until lately the operations performed for its relief were attended with only indifferent success. One plan of treatment recommended was to dissect away the adhesion and interpose a shell of glass between the raw surfaces, but as healing invariably commenced at a point remote from the free margin of the lid, the shell was gradually pushed out and the adhesion re-established.

The insertion of pieces of wire deeply beneath the adhesion, which were left in until the walls of the canal made by them had healed, the remainder of the adhesion being then divided with scissors, was followed by no more satisfactory results.

Teale's operation.

Lately, an operation has been introduced by Mr. P. Teale, of Leeds, the performance of which has been attended with the best success. The operation has for its object the separation of the raw surfaces by a piece of conjunctiva, taken from some other part of the eyeball. The following is an extract from the account of the operation given by Mr. Teale in the Transactions of the Fourth Ophthalmic Congress, 1872. "The patient being under the influence of an anæsthetic, the eyelid is freed from its attachment to the lid; next, a band of somewhat circular form is marked out, with a sharp knife, upon the sound conjunctiva; the band commences at one end of the gap left by liberation of the lid and passes round the sound side of the cornea, terminating at the opposite extremity of the gap.

"Four stitches are then inserted, two on each edge of the flap thus formed. The flap is next separated on its *under surface*, whilst its extremities are left continuous with the conjunctiva; it is thus drawn across the surface of the cornea, and fixed, raw surface downwards, into the gap formed by the liberation of the eyeball from the lid; it is secured in its new position by the sutures already alluded to, aided by as many others as may appear necessary."

Mr. Teale states that "the operation is most tedious," and that he rarely completes it within the hour.

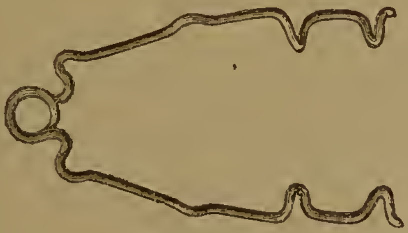
Anchyloblepharon signifies an adhesion of the lids to each other; the adhesions must be divided with scissors, and, if possible, some skin or conjunctiva interposed between the raw surfaces. If this cannot be done, reunion must be prevented by passing a probe between the lids daily.

Blepharophymosis.

Narrowing of the palpebral aperture (Blepharophymosis) requires to be remedied by operation. It is usually a result of granular ophthalmia and is accompanied by eutropion, displaced tear puncta, and consequent watering of the eye.

The operation can be thus performed:—The lids being kept widely open and on the stretch by a wire speculum (Fig. 86), an incision should be made with strong scissors through the outer canthus. A flap of conjunctiva, of somewhat conical shape, should then be marked out on the surface of the eyeball, the flap freely dissected from the subjacent structures, but left attached at its base, which is towards the cornea, and then fixed by sutures in the incision made by the scissors, in such a manner as to keep the raw edges separated by a mucous surface.

FIG. 86.



Wire speculum.

Tarsoraphy.

It is sometimes necessary to narrow or close entirely the palpebral aperture. The operation is known as *tarsoraphy*, and can be performed as follows:—The lid being seized with forceps, with a small iridectomy knife a portion of *the inner edge* of its margin should be removed, care being taken not to cut away any of the outer edge containing the lashes, nor to wound the tear puncta or canaliculi. The opposite lid should then be treated in the same manner, and the raw edges brought together by sutures; firm union will soon take place between them.

Ptosis.

Ptosis signifies a drooping of the upper eyelid to a greater or less extent, with inability to raise it. Ptosis occurs with divergent strabismus and more or less impairment of the mobility of the eyeball, generally, but not invariably, accompanied by dilatation and fixity of the pupil in cases of paralysis of the third nerve.

It may also be met with as a congenital defect, and occurs sometimes after severe inflammation of the lid, or protracted intolerance of light, and constant spasmodic action of the orbicularis muscle. Women past the middle period of life, with a superabundance of loose skin about the face, are also subject to a form of partial ptosis.

Treatment.

TREATMENT.—In cases of ptosis occurring as a result of paralysis of the third nerve treatment must be directed against the cause of the paralysis, no operation being advisable; other forms can be remedied by removal of some skin and orbicularis muscle from the surface of the lid.

Operation for ptosis.

The operation may be performed as follows:—The skin just above the margin of the lid should be pinched up with forceps, the amount included between their blades being such as to raise the margin of the lid well above the upper border of the pupil.

Then with scissors a strip of skin of the required width should be removed, along the whole extent of the lid, parallel to its margin; the orbicularis muscle should then be cleanly dissected off the tarsal cartilage to about the same extent, the wound closed by one or two fine sutures, and the eye bound up with wet lint and a bandage.

The wound will heal in the course of a few days, and the shortening caused by the removal of the skin and muscle, and subsequent cicatrization should keep the lid in the desired position.

THE LACHRYMAL APPARATUS.

Lachrymal gland.

The lachrymal gland is occasionally the seat of malignant or other growths, and may require extirpation.

Cysts.

A cyst is sometimes met with caused by obstruction of one of the ducts of the gland and accumulation of secretion. The disease is known as *dacryops*.

Treatment.

If the cyst be opened through the skin it will leave a fistulous opening. Its treatment consists in establishing an opening into it from the surface of the conjunctiva; this is easily done by passing a curved needle armed with silk from beneath the upper lid through the wall of the cyst into its cavity, and out again at a convenient distance; the silk should then be drawn through, and the portion of cyst-wall included between the entrance and exit of the needle firmly ligatured; the ligature will slough out and leave a permanent opening.

Tear puncta and canaliculi.

The tear puncta and canaliculi.

The tear puncta in the normal condition should lie in contact with the ocular conjunctiva; they may be either everted, as seen in old and neglected cases of tinea, or rolled somewhat inwards; they are sometimes found entirely obliterated, either by disease or injury, burns of the eyelids being the most common cause of the obliteration.

The canaliculi may also be found more or less obstructed in any part of their course. Any of these conditions are accompanied by troublesome watering of the eye. They can be remedied by slitting the tear puncta and canaliculi.

Lachrymal sac.

Inflammation.

Abscess.

The lachrymal sac often becomes the seat of acute inflammation, which may arise in the sac itself, spread to it from the conjunctiva, or be caused by disease of the surrounding bones. It may end in resolution or go on to the formation of an abscess. Inflammation of the lachrymal sac is characterised by the presence of a dusky red, tense swelling, situated at the side of the nose, close to the inner canthus, the swelling and redness often extending outwards along both the upper and lower lids. If an abscess form, the swelling becomes soft and fluctuating; one or both sacs may be affected.

Treatment.

TREATMENT.—At first, hot fomentations and poultices must be applied, and attention paid to the general health; if abscess form, the pus must be let out by a free incision. If an abscess of the lachrymal sac be allowed to burst a fistulous opening will very probably be left, but if a free opening be made the wound heals readily.

Mucocele.

Distension of the lachrymal sac (Mucocele).

The lachrymal sac not unfrequently becomes distended, forming a tumour of varying size beneath the internal palpebral ligament (tendo oculi); pressure on the tumour causes the escape of a transparent, somewhat tenacious fluid, consisting of mucus and tears; in some cases the fluid may be thickened from the admixture of pus-cells. Distension of the sac is caused by stricture of the nasal duct and consequent accumulation of secretion; it is accompanied by more or less watering of the eye, and may be remedied by relieving the stricture of the duct.

Blennorrhœa.

Discharge from the lachrymal sac (Blennorrhœa).

A muco-purulent or purulent discharge from the sac is often met with, following inflammation, especially if disease of the adjacent bone exist. It may be treated—1st. By insuring a free exit for the discharge by slitting the canaliculus, and passing a large probe down the lachrymal duct. 2nd. By washing out the sac. 3rd. By obliteration of the sac.

Stricture of nasal duct.

Stricture of the nasal duct may be met with in any part of its course; the obstruction, however, is most frequently found at its junction with the lachrymal sac. Occasionally the duct is found almost obliterated by dense bony deposit.

Fistula of lachrymal sac.

Fistula of the lachrymal sac occurs as a small, sometimes scarcely perceptible opening, situated at some point over the sac; it generally accompanies obstruction of the nasal duct. If the passage be re-established, the fistula will probably close.

Operations on the tear passages.

The operation of slitting the tear puncta and canaliculi may be performed thus:—The patient should be seated in a chair, the operator standing behind him. (*See* Fig. 82, p. 330.) Then, supposing the lower punctum and canaliculus on the right side to be operated on, the small and ring fingers of the left hand should be placed upon the patient's face, near the outer canthus, the lids drawn tight with these two fingers, and kept so; then a small grooved director (Fig. 87) should be taken in the right hand and passed at first vertically to the margin of the lid, through the tear punctum; its handle then depressed, and its point passed horizontally along the canaliculus into the sac. To ascertain that the point of the director is in the sac, the tension of the lids must be relaxed and the director pushed gently onwards; if there be any puckering at the inner canthus when the director is thus pushed, its point has not entered the sac, and a further attempt must be made; if no puckering occur, the lids should be brought again into a state of tension, and the handle of the director transferred to the thumb and forefinger of the left hand; a cataract or any small knife that will cut, should then be taken in the right hand, and run along the groove of the director well into the sac, the knife and director being then withdrawn together; the upper lid must be kept out of the way by

FIG. 87.

Grooved director for slitting canaliculus.

Slitting canaliculus.

one of the fingers of the right hand. The operation can be performed on the left side in the same manner, with the exception that the hands are reversed.

The upper punctum and canaliculus sometimes require to be slit; the operation is not quite as simple as that on the lower, but is performed in much the same way. In lieu of the grooved director and knife, a small probe-pointed canaliculus knife may be employed; it should be passed through the tear punctum and canaliculus in the same manner as the director, and will cut its way out as it goes.

After-treatment.

The patient must be seen at intervals of two or three days for a week, or longer, after the operation, and a probe passed along the incision to prevent it closing.

Probing nasal duct.

Probing the nasal duct.

Bowman's probes.

For the treatment of stricture of the nasal duct a set of silver probes (Bowman's) are used; there are three probes in a set, the two extremities of each being of different thicknesses, so that there are six sizes, No. 1 being the smallest, No. 6 the largest.

Passing probe.

To pass a probe down the nasal duct, the canaliculus should be first slit, or, what is better, should have been slit at some previous time. The Surgeon should stand behind the patient in the same position as for performing the last operation; and the lids being made tense in the same manner, the probe should be passed along the slit canaliculus until the point is well within the sac, as shown by the absence of puckering at the inner canthus on relaxation of the tension of the lids; the opposite extremity should then be raised along the margin of the orbit until the probe has attained a vertical direction, care being taken, while so doing, to keep the end which is in the sac pressed firmly against its inner side; the probe, having been brought into a vertical position, should be pushed gently but firmly downwards and slightly backwards, in the direction of the duct; when it has been passed as far as it will go it should be slightly withdrawn, so as to raise its end off the floor of the nose. If the probe has been properly passed down the duct its upper part will remain firmly in contact with the margin of the orbit; but if it moves freely about, the probe is not in the duct, but has been forced through its wall. This little accident is of no particular moment, and needs only that the probe shall be withdrawn and passed afresh in the right direction.

Accidents.

If the precaution be not taken to ascertain that the end of the probe is well within the sac before an attempt is made to pass it down the duct, it may slip backwards into the orbit, or forwards and downwards in the cellular tissue of the cheek. A probe having been satisfactorily passed, should be left in for about twenty minutes; the operation should be repeated about twice a week. The treatment of stricture of the lachrymal duct is, on the whole, unsatisfactory, but the probing should be carefully and perseveringly carried out. It is well always to commence with the largest probe, No. 6, and try a smaller one if this cannot be passed.

Washing out lachrymal sac.

Washing out the lachrymal sac.

For washing out the lachrymal sac a good syringe fitted with nozzles of different sizes is required. One of the nozzles should be fitted to the syringe, which has been previously filled with fluid (water, a weak solution of nitrate of silver, chloride of zinc, &c.), the nozzle should then be passed into the sac and the fluid injected; the patient's head must be bent forwards during the injection, or the fluid will run back along the floor of the nose into the pharynx.

Obliteration of the lachrymal sac.

Obliteration of lachrymal sac.

In some cases of obstinate discharge from the sac, especially if dependent on diseased bone, the discharge may be stopped, and the patient made more comfortable by closing up the sac entirely; of course, more or less watering of the eye will remain after the operation, but is far to be preferred to the annoyance of a constant purulent discharge.

Obliteration of the sac may be secured in any of the three following ways. A free incision having been made into it, and the blood carefully sponged out, its lining membrane may be destroyed—(1) by filling its cavity with a thick paste of chloride of zinc and starch, in equal parts, enclosed in a small piece of lint; (2) by the application of nitrate of silver, or (3) by the galvanic cautery. By any of these procedures adhesive inflammation is set up, more or less obliteration of the sac following.

Operations for obliteration of the lachrymal sac are by no means always successful, and may have to be repeated, perhaps more than once, before a satisfactory result has been obtained.

THE CONJUNCTIVA.

The conjunctiva.

But few operations are performed on the conjunctiva specially; it is, of course, cut in some of the operations on the eyelids and in that for strabismus, and some others.

Warts.

Warts are occasionally found on some part of the membrane; they require to be removed with scissors.

Pterygium.

Pterygium is a peculiar, somewhat triangular growth, the base of which is situated in the ocular conjunctiva generally near the inner canthus, the apex encroaching more or less upon the margin of the cornea, or passing for a considerable distance upon its surface. The growth is of a reddish colour and variable density; it consists of hypertrophied connective tissue.

Pterygium is not common in this country, and when met with is usually found to occur in sailors who have been in the east. If it give rise to any inconvenience or impairment of vision it must be removed by operation.

Transplantation.

The patient should lie on the couch; the lids be opened by a wire speculum; the growth seized with toothed forceps and with a cataract knife dissected clean from the surface of the cornea. A small portion of conjunctiva should then be removed parallel with the margin of the cornea, and the apex of the growth fixed by a suture in the wound. The eye should be kept bound up for a few days with wet lint and a bandage.

If a pterygium be simply cut off it will, in all probability, grow again, but if it be transplanted it shrivels up, and disappears without giving further trouble.

Pinguicula.

Pinguiculæ are small yellowish growths about the size of a small split pea, situated beneath the conjunctiva, generally near the outer and inner margin of the cornea; the little growths are surrounded by a few large blood-vessels; occasionally they are the source of constant irritation, causing the eyes to be bloodshot and uncomfortable. Pinguicula can be removed, if desired, by making an incision over it, turning back the conjunctiva, then seizing the little growth with forceps, and dissecting it away from the parts beneath. The growth having been removed, the conjunctiva should be closed over the wound by a suture; the eye must be kept bandaged for two or three days after the operation.

Fatty tumour.

Lipoma is met with as a tumour projecting beneath the upper lid, near the fornix, and often between the superior and external recti muscles; it somewhat resembles a third lid. If the tumour gives any trouble it must be removed by operation, thus:—The patient lying on the couch, the lids should be kept as widely open as possible by a wire speculum, an incision made with a cataract knife through the conjunctiva over the tumour, and its most projecting portion seized with toothed forceps and removed with scissors; care must be taken not to drag upon the growth, as it is continuous with fat in the cavity of the orbit, a great portion of which might be pulled out. As much of the tumour as is thought necessary having been removed, the conjunctiva should be closed over it with sutures, and the eye bound up.

Nævus.

Nævus is occasionally met with in the conjunctiva; it may be destroyed by the galvanic cautery, due precautions being taken to guard the eyeball from injury during the operation, and to prevent as much as possible the evils arising from subsequent cicatrization.

Cancerous ulcers.

Cancerous ulcers may also be met with, and require similar treatment.

Cysts.

Cysts containing a clear serous fluid are occasionally met with in the conjunctiva; they must be punctured, when they at once subside, but sometimes re-form, in which case a portion of the cyst-wall must be excised, or a fine seton passed through it.

Cysticercus.

Cysticercus may be met with; it should be treated by puncture of the cyst.

EXTERNAL MUSCLES OF THE EYEBALL.

Strabismus.

Strabismus (squint).—"Strabismus is a deviation in direction of the axes of the two eyeballs, in consequence of which the two yellow spots receive images from different objects. In convergent strabismus the two visual lines do not cross each other at the point it is desired to observe; only one of the two, that of the undeviating eye, reaches it. Under this deviation not only does the expression of the face suffer from want of symmetry in its most eloquent parts, but the power of vision, at least in one of the eyes, is usually disturbed," and the squinter always loses the advantage of binocular vision. (Donders.)

Causes.

Strabismus must not be looked upon as a special form of disease; it is found in by far the greater number of cases associated with some anomaly of refraction, which, being the primary cause of the deviation, gives rise to the strabismus; other conditions which may induce strabismus will be subsequently considered.

Varieties.

Two forms of squint are commonly met with. 1. Convergent. 2. Divergent. Other rare forms are superior and inferior strabismus; these will receive no further notice.

Convergent strabismus is the most common of all, and is almost always associated with hypermetropia.

Divergent strabismus is usually the result of myopia.

Convergent strabismus.

Convergent strabismus, as just stated, is nearly always the result of hypermetropia. The question naturally arises, how does hypermetropia produce it?

Connection with hypermetropia.

The hypermetropic individual always accommodates strongly when looking at even a distant object; as the object is brought nearer, the tension of accommodation must be increased. As stated at page 296, accommodation is associated with convergence of the visual lines. Now, the greater the degree of convergence the more strongly can the accommodation be brought into play; consequently there is an ever increasing inclination on the part of the hypermetropic individual to converge too strongly, in order to bring his accommodation into the highest possible state of tension. If the convergence of the visual lines be excessive, or if they do not meet in the same point, convergent strabismus results.

The question next arises, why do not all hypermetropic individuals squint? The reason is that if both eyes are of the same refraction, and have equal acuteness of sight, there is always such a desire to maintain binocular vision that the visual lines will remain directed to the same point, even though the eyes are not accurately accommodated for that point, the individual being content with ill-defined retinal images rather than increase his convergence, and thus sacrifice binocular vision.

But let vision of one eye be less acute than that of the other, or let there be a difference of refraction between the two, the desire for binocular vision is lost, or its value very much lessened; the necessity for a well-defined image on one retina is immediately felt; the accommodation is put fully on the stretch, and with it the degree of convergence becomes excessive, both visual lines being directed to points nearer to the eyes than that for which they are accommodated, and the deviation of the more defective eye being greater than that of its fellow.

Treatment.

TREATMENT.—Slight cases of convergent strabismus, especially if the deviation is not constantly present, but only occasional, may be cured by the use of glasses which accurately neutralize the existing hypermetropia.

More extreme cases require division of the internal rectus tendon in one or both eyes.

A difficulty often arises in deciding whether only one or both eyes shall be operated on.

If it is found that one eye squints habitually, the other being always used for fixing an object, only deviating slightly when it is excluded, and an attempt made to fix with the habitually squinting eye, division of the internal rectus of that eye which habitually deviates alone is necessary.

Alternating strabismus.

If each eye deviates alternately (alternating strabismus), and to the same extent, division of one internal rectus may be sufficient; but if after the operation the squint continue, tenotomy of the internal rectus of the other eye should be performed.

If one eye squint habitually, the other having an inclination to deviate at times, and if this deviation becomes well marked when the eye is excluded and an object fixed with the more or less habitually squinting eye, then the internal rectus in both eyes must be divided. In any case, if there be a doubt as to whether one or both eyes should be operated on, it is well to be on the safe side, and do only one at a time.

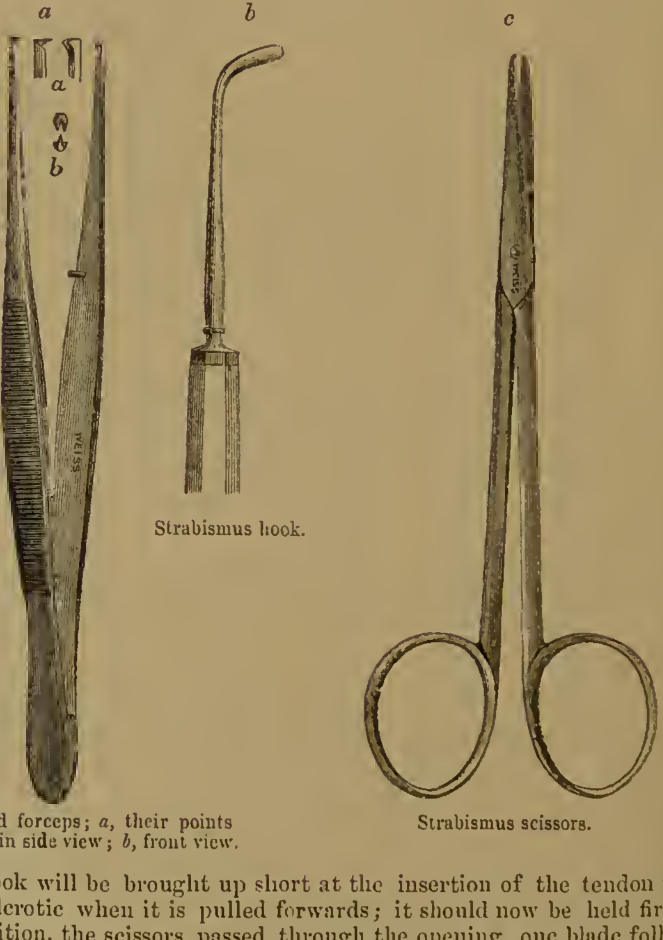
Operation for convergent strabismus.

Operations for convergent strabismus.

There are two principal methods of operating for convergent strabismus. 1. The patient being placed in the usual position (Fig. 83, p. 330), the operator should stand in front on the right side of the couch, or sit upon its edge, the eyelids being kept well open with a wire speculum; the conjunctiva and subconjunctival fascia should be seized with the toothed forceps (Fig. 88*a*) at a point about midway between the margin of the cornea and semilunar fold, and just below the inferior margin of the tendon of the internal rectus muscle; an incision should then be made with strabismus scissors (Fig. 88*c*) through the conjunctiva and subconjunctival fascia, well down to the sclerotic; the strabismus hook (Fig. 88*b*) should now be passed through the opening and inserted between the tendon and the eyeball; if it is properly passed the hook will be brought up short at the insertion of the tendon into the sclerotic when it is pulled forwards; it should now be held firmly in position, the scissors passed through the opening, one blade following the hook between the tendon and the eyeball, the other being kept outside the tendon, which is thus included between the two blades.

Instruments for strabismus.

FIG. 88.



Strabismus hook.

Toothed forceps; *a*, their points shown in side view; *b*, front view.

Strabismus scissors.

Division of the tendon.

The tendon should now be divided by one or two sharp strokes with the scissors; the scissors withdrawn, and the hook pulled forwards; if the latter meets with no resistance, but passes freely up to the corneal margin, the operation has been successfully performed; however, to make sure of this, the hook should be withdrawn, the action for hooking the tendon repeated, and any fibres that may have escaped division cut through.

Connection with subconjunctival fascia.

On the division of the tendon the muscle retracts, the distance being limited by the subconjunctival fascia with which it is intimately connected. If the eye is not properly directed after simple division of the tendon, a greater effect may be produced by further freely severing the subconjunctival fascia. This operation is known as the subconjunctival.

2. For the second operation, the position of the patient and Surgeon should be the same, and the lids be kept open with the wire speculum as in the subconjunctival operation.

An incision should be made with scissors through conjunctiva and subconjunctival fascia, over the insertion of the tendon, instead of below its inferior margin; the tendon then picked up with the strabismus hook, and divided close to the sclerotic. The wound in the conjunctiva should be afterwards closed with a fine suture. No after-treatment is required for strabismus operations; the patient may go about as usual and simply keep the eyes clean. But if, when the eyes have quite recovered from the effects of the operation, an inclination to return of the squint is manifested, the degree of hypermetropia must be carefully ascertained, and glasses which thoroughly neutralize it ordered to be used for all purposes. In most cases this will be found sufficient; but if after the glasses have been perseveringly worn for some weeks no effect is produced, the operation should be repeated in one or both eyes.

Use of anæsthetics.

Use of anæsthetics in operations for convergent strabismus.

Whether anæsthetics should be employed or not in squint operations appears to be a matter of opinion; some eminent oculists never employing them, others again rarely operating without. For my own part, I prefer not to employ an anæsthetic if the patient is pretty steady, but with children and nervous adults I always use one, but take care that a full effect is not produced, and if there is any doubt as to whether one or both eyes are to be operated on I allow the patient to come nearly to after finishing one eye, so as to ascertain the effect produced by what has been done; if an anæsthetic is given to such an extent as to exert its fullest influence, and produce thorough muscular relaxation, an erroneous idea of the effect of the operation is likely to be formed, and on the return of consciousness the squint may remain as bad as ever.

Other conditions causing convergent strabismus.

Other conditions than hypermetropia which may produce convergent strabismus are—

1. Disease of the brain.
2. Paralysis of the external rectus muscle.
3. Inflammatory or other changes in the internal rectus muscle itself, producing shortening.

In the first two of these no operation is advisable; the third may sometimes be remedied by operative interference.

Divergent strabismus.

Divergent strabismus is, as above stated, the result of myopia; it is usually consequent on high degrees of the anomaly, and is brought about as follows:—The highly myopic individual, as is well known, requires to bring objects very near the eyes to see them distinctly, consequently a very high degree of convergence is necessary to keep both visual lines directed to the same point; now, not only has a high degree of convergence to be maintained, but in myopia the length of the eyeball and the consequent impairment of its mobility place the internal recti at a disadvantage. Moreover, in order to direct the visual lines of myopic eyes to the same point, a greater proportionate amount of convergence is required than in emmetropia.

Causes.

As a consequence, the internal rectus of one eye sooner or later becomes wearied and gives in, and the eye deviates outwards, binocular vision being sacrificed.

Cure by glasses.

TREATMENT.—Many cases of divergent strabismus may be remedied by the use of concave glasses, which enable the individual to see distinctly at a distance up to which convergence of the visual lines can be maintained without undue strain of the internal recti muscles.

If in spite of the use of glasses the divergence continues, it must be remedied by operation. In cases where the eye only deviates outwards, after an object has been looked at for some considerable time, subconjunctival division of the external rectus of the deviating eye will suffice for a cure; but in cases where one or both eyes diverge constantly, and the visual lines can only be made to meet in one point by a great effort, or not at all, the operation of readjustment must be performed.

Division of external rectus.

Operation of readjustment.

This operation can be performed as follows:—The patient being placed in the usual position (Fig. 83, p. 330) and thoroughly anæsthetised, the operator should stand behind, fix the lids open with a wire speculum; with scissors make an incision through conjunctiva and subconjunctival fascia, over the insertion of the external rectus; hook up the tendon, and divide it close to the sclerotic.

An incision should then be made through conjunctiva and subconjunctival fascia, about midway between the insertion of the internal rectus and inner margin of the cornea, the incision being of such a length as to reach about two lines above and a like distance below the margins of the tendon, which should then be hooked up and divided. The muscle and subconjunctival fascia should be freely separated from the parts beneath, and together with the conjunctiva turned back towards the caruncle. Two curved needles holding fine silk should then be passed through the tissues next the margin of the cornea, and the silks firmly tied, two free ends being left; the needles should then be carried from within outwards, through the muscle, subconjunctival fascia, and conjunctiva, as near the inner canthus as possible, and the silk drawn through; a considerable portion of the muscle and other tissues should then be removed with scissors, the free ends of the two fine pieces of silk and the portions to which the needles are still attached then tied firmly together (the eye being rolled well inwards by an assistant as the knots are pulled tight); the ends of the two sutures should then be cut off close.

Introduction of sutures.

The last step of the operation is to unite the wound in the conjunctiva made for the division of the external rectus by a single suture.

The eye should be bound up with wet lint and a bandage. The sutures will probably require removal in about four or five days, but may be left longer, if they cause no irritation.

Other causes of divergent strabismus.

Divergent strabismus is met with in cases of paralysis of the third nerve, and also occurs if the sight of one eye has become much impaired, and binocular vision no longer possible. In the former of these cases no operation is advisable; in the latter no improvement of sight is to be expected from readjustment; the operation may, however, be performed simply to remedy disfigurement.

THE CORNEA.

Affections of cornea requiring operation.

The affections of the cornea which require an operation upon the structure itself are five:—1. Sloughing ulcer. 2. Conical cornea. 3. Corneal opacity. 4. Staphyloma. 5. Lodgment of foreign bodies.

Paracentesis.

Paracentesis, or tapping the cornea.—This operation is sometimes performed in cases of sloughing ulcer, or suppuration, threatening perforation; by the timely evacuation of the contents of the aqueous chamber a large rupture of the corneal tissue, with its accompanying evils, may in many cases be avoided.

Iridectomy, however, is to be preferred to paracentesis. Tapping the cornea may be done thus:—The patient being in the usual position (Fig. 83, p. 330), the operator should stand behind and fix the lids open by a wire speculum or by the fingers. A broad needle should then be passed through the cornea at some convenient part of its margin; when the point of the needle has fairly entered the anterior chamber, its handle should be rotated, so as to bring the breadth of the blade across the incision and thus open it; as soon as the contents of the anterior chamber have flowed out, the needle should be withdrawn, a drop of atropine solution placed between the lids, and the eye bound up in the usual manner.

Conical cornea.

Conical cornea, as the name implies, signifies an alteration in its curvature, of such a nature that the cornea assumes the form of a cone. The origin of the affection cannot clearly be traced.

The most prominent symptom is gradually increasing myopia, which cannot be remedied by concave lenses. On looking at the cornea in profile, its conical form is very evident.

Ophthalmoscopic appearance.

On examination with the ophthalmoscope by the direct method the apex of the cone, which may, however, be the seat of some opacity, appears brightly illuminated; around this bright portion is a dark ring corresponding to the sides of the cone, this being again succeeded by an area giving a bright reflection, and corresponding to a portion of the cornea which retains more or less its natural curvature.

Objects occupying the fundus of the eye are seen through the apex and sides of the cone near its base, in an inverted position, as in myopia, and appear to have a whirling motion as the observer changes his point of view from side to side.

Treatment.

Treatment.—Conical cornea can only be remedied by operative interference; two methods of operating are practised, the object of each being to flatten the cone, and restore to the part more or less of its natural curvature.

Removal of apex of cone.

In one operation an elliptical portion including the whole thickness of the cornea is removed from the apex of the cone. The operation can be performed thus (for the position of patient and operator *see* Fig. 83, p. 330):—An anæsthetic should be given, the lids held open by a wire speculum, and the eyeball fixed by seizing with the toothed forceps the conjunctiva and subconjunctival fascia at some point near the corneal margin. A long thin extraction knife should then be thrust through the cone from side to side, and a small flap formed by cutting out either upwards or downwards; the flap so formed should then be seized with iris forceps and removed with scissors.

In this operation the anterior chamber is opened and the cornea collapses as soon as the first incision is made. Care must be taken that the portion removed includes the most prominent part of the cone, and that the opening left is exactly opposite the pupil.

Occurrence of anterior synechia.

After the operation the speculum must be very carefully removed, the lids gently closed and bandaged in the usual way; the eye must on no account be examined for a week, so as to give time for the opening in the cornea to fill up. The wound will, in all probability, heal in the course of ten days, the anterior chamber being restored. The margin of the pupil is not unfrequently caught up in the incision, an anterior synechia resulting.

The operation described gives the most satisfactory results, the curvature of the cornea being greatly improved, and a corresponding amount of vision regained.

Removal of portion of thickness of cornea.

In the second operation a superficial portion only is removed from the apex of the cone with a small trephine, a raw surface being left which by its subsequent cicatrization and contraction causes considerable flattening of the cone.

Tinting.

Tinting the cornea is called for in cases of dense white opacity (leucoma), causing considerable disfigurement. The operation can be performed as follows:

For position of patient and operator *see* Fig. 83, p. 330. An anæsthetic should be given.

The operator should place the wire speculum between the lids, fix the globe with the toothed forceps, paint some Indian ink upon the opacity, and prick it thoroughly in with a bunch of needles fixed in an ivory handle; the ink should be sponged away from time to time in order to allow the operator to see what progress he has made.

The opacity having been thoroughly tinted, the speculum should be removed; no bandage need be applied, and no after-treatment is necessary; very little irritation follows. If after the lapse of a week or ten days the opacity do not appear sufficiently blackened, the operation may be repeated.

Perforation of anterior chamber.

If the ink be allowed to get into the wound made in the conjunctiva by the toothed forceps, a black mark will be left; care should therefore be taken to fix the globe at a point to which the ink cannot run. Should the anterior chamber be opened, the operation must be discontinued, as the lens may be wounded.

Total staphyloma.

Partial staphyloma.

Staphyloma of the cornea signifies a bulge on its surface caused either by yielding of its structure or more commonly by prolapse of iris through a perforation in it, the prolapsed portion being firmly coated over with inflammatory material. Staphyloma is said to be "total" where the whole of the cornea is affected, "partial" when some portion of it retains its normal curvature. Total staphyloma should be removed by abscission (*see* p. 364). Partial staphyloma can be removed as follows:—The position of patient and operator should be as at Fig. 83, p. 330, and an anæsthetic should be administered. The lids being kept open by the wire speculum, a curved needle armed with fine silk should be passed through the base of the staphyloma, a somewhat elliptical portion of which should then be removed with a straight cataract knife; the silk should then be drawn through, the edges of the gap made by the removal of the elliptical portion brought together, and the eye bandaged in the usual way. The suture may be removed in the course of three or four days.

Removal of foreign bodies.

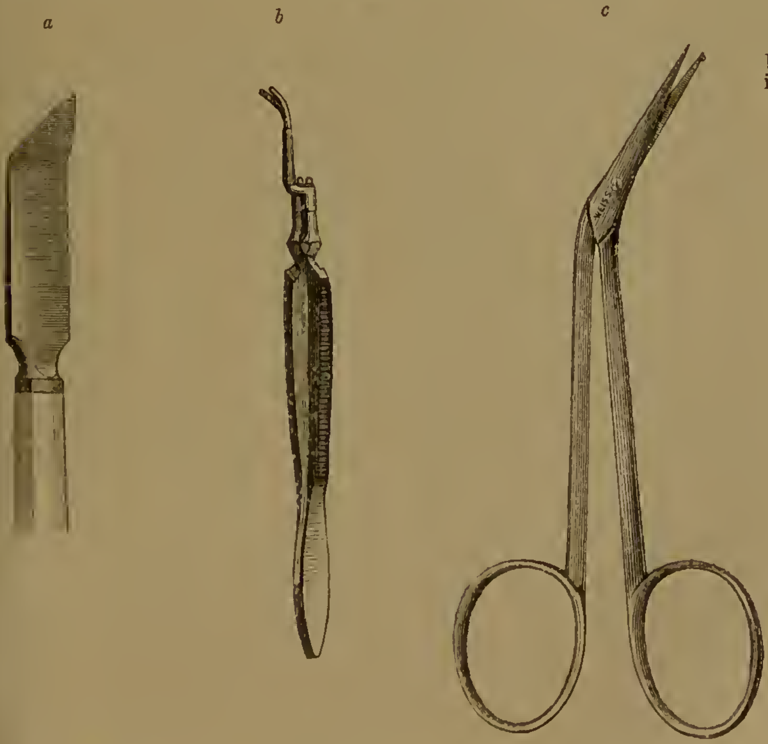
Foreign bodies.—Small fragments of metal, chips of stone, and thorns, &c., are not unfrequently found lodged in the cornea. To remove them the position of patient and operator should be as Fig. 82, p. 330. No anæsthetic need be administered. The lids should be kept open by the fore and ring fingers of one hand, and the globe steadied by gently pressing upon it with the second finger; the foreign body should then be carefully lifted from its bed with the point of a knife or small spud held lightly in the other hand. Foreign bodies, especially thorns, are sometimes so firmly and deeply embedded that they require to be cut out.

THE IRIS.

Iridectomy.

Iridectomy is called for in all cases in which it is desirable to influence the tension of the eyeball or its nutrition; it is associated with some operations for cataract (in a somewhat modified form), is one of

Fig. 89.



Iridectomy instruments.

a. Bent iridectomy knife. b. Iris forceps. c. Iris scissors.

the methods of making an artificial pupil, and is employed in some other conditions.

The operation is performed (1) to influence tension.

To influence tension in sloughing ulcers.

(*a*) *In sloughing ulcers*, or suppuration of the cornea, accompanied by pain, and threatening perforation. In such cases the performance of iridectomy gives almost instant relief to the most severe pain, and in all probability saves the cornea from rupture.

For swollen lens.

(*b*) *In injuries of the eyeball*, in which the crystalline lens, being wounded, has become opaque and swollen, and is pressing on surrounding parts, causing severe pain and threatening the integrity of some of the delicate structures within the globe. In these cases, not only does iridectomy diminish tension, and so relieve pain, but gives room for any subsequent swelling of the lens.

In corneal staphyloma.

(*c*) *In staphyloma of the cornea* the performance of iridectomy often causes complete subsidence of the projection.

In glaucoma.

(*d*) *In glaucoma* a timely and well-performed iridectomy causes instant and lasting diminution of tension and places the eye in comparative safety; the operation should be performed on any eye that can distinguish *bright* light, and in acute glaucoma must be tried even if all perception have been lost for some days, and to relieve pain in any case whether there be perception of light or not.

To influence nutrition.

(2) To influence nutrition, iridectomy should be performed in chronic choroido-iritis, recurrent iritis, and in cases of total exclusion of the pupil, where there is no communication between the anterior and posterior division of the aqueous chamber.

In cataract operations.

(3) Associated with operations for cataract, iridectomy should be performed previous to a needle operation if much swelling of the lens is anticipated; or may require to be done after the needle has been used if pain or increase of tension occur.

The operation should also be performed at some time previous to, or simultaneously with, linear extraction of cataract.

(4) Iridectomy for artificial pupil is mentioned at another page.

Other conditions requiring iridectomy.

(5) Other conditions calling for the performance of iridectomy are—
  (*a*) Hæmorrhage into the vitreous humour.
  (*b*) Displacement of the retina.
  (*c*) As an aid to the removal of foreign bodies from the globe.
  (*d*) Some peculiar conditions of intra-ocular circulation.

Operation of iridectomy.

Instruments required.

Operation of iridectomy.

Instruments.—A wire speculum (Fig. 86), a straight or bent iridectomy knife (Fig. 89*a*), a pair of toothed forceps (Fig. 88*a*), a pair of iris forceps (Fig. 89*b*), iris scissors (Fig. 89*c*), and a curette (Fig. 92*a*). For the position of patient and Surgeon *see* Fig. 83, p. 330. The patient should be placed fully under the influence of an anæsthetic; the wire speculum placed between the lids, which are thus kept widely open; the eyeball fixed by seizing the conjunctiva and subconjunctival fascia near the corneal margin with the toothed forceps; then, with a straight or bent iridectomy knife of medium size, an incision should be made in the sclerotic, in such a position that the knife enters the anterior chamber quite at its peripheral part, and close to the anterior surface of the iris.

The knife, having entered the anterior chamber, should be pushed steadily on (care being taken to keep its point well forwards towards the cornea, so as not to wound the lens), until the point is opposite the centre of the pupil. The point should then be turned to one side, so as to be out of the pupillary area, and the knife slowly and gently withdrawn, the hold of the forceps being let go at the same time. The incision thus made should be of such a length as to correspond to a little more than one fourth of the circumference of the iris.

Removal of portion of iris.

The next step in the operation is the removal of a portion of the iris. If, as is not unfrequently the case, the iris has become prolapsed, it needs only to be seized with the forceps, and a piece of the desired size removed with the scissors. If the iris does not protrude, the iris forceps should be entered shut, through the wound in the sclerotic, and pushed on until the extremities of their branches are opposite the nearest portion of the pupillary margin; they should then be allowed to open of themselves, and the iris will be pushed between the branches by the pressure of the parts behind; no backward pressure must be made with the forceps, but they should be gently closed again and withdrawn, carrying the iris with them; as soon as the iris has been drawn through the wound it should be cut across with the iris scissors, close to one angle of the wound, and then drawn over to the other angle, and a piece cut off; the curette should be passed between the lips of the wound so as to push back any portions of iris that may have become entangled in it. The eye should then be bound up with lint and a bandage. The form of the pupil after a well-performed iridectomy should resemble Fig. 91 D.

Introduction of forceps.

Position of portion of iris removed.

With regard to the position of the portion of the iris to be removed, opinions are at variance.

If the Surgeon be a skilful and experienced operator, and has the aid of a competent assistant, the iridectomy should be done upwards, so as to place the gap made beneath the upper lid, and thus conceal it as much as possible.

To perform iridectomy upwards, a bent iridectomy knife should be used, and the incision made in the sclerotic above the upper margin of the cornea an assistant should then draw the eyeball downwards with forceps, the iris forceps should be inserted, and the portion of iris removed as directed above.

An inexperienced operator will find it much easier to remove the portion of iris from its outer and lower segment. In this case a straight iridectomy knife can be used, and no assistant is required. The result is rather an ugly gap; the disadvantage of which, however, is quite counterbalanced by the ease and safety with which the operation can be performed.

Accidents during iridectomy.

Accidents which may happen during the operation of iridectomy, and difficulties which may be encountered.—The accidents which may occur are—

Wound of lens.

(1) Wound of the lens from insufficient care being taken to keep the point of the knife well forward, and out of the area of the pupil. The accident will, in all probability, be followed by the formation of a traumatic cataract.

Loss of vitreous.

(2) Escape of vitreous humour; this is very likely to occur in hard eyes, if the knife be too quickly withdrawn, or if undue pressure be exerted on the globe with the forceps.

Detachment of iris from insertion.

(3) The iris may be torn away from its insertion at a point opposite to the incision, if undue traction be exercised upon it with the iris forceps.

Difficulties.

Difficulties.—The iris may be found so rigid that it cannot be seized with the forceps, or so rotten that only very small portions can be brought away; sometimes it bleeds profusely when touched, filling the anterior chamber with blood, and considerably hindering the operation.

Artificial pupil.

Artificial pupil.—The operation for artificial pupil is performed to open a new path for rays of light to the retina, the natural passage being obstructed.

The formation of an artificial pupil is indicated in the following cases:—(1) In opacity of the cornea, with or without anterior synechiæ. (2) In closure of the pupil. (3) In extensive posterior synechiæ. (4) In central opacity of the lens or its capsule.

Position of new pupil.

The artificial pupil must be small, as near central and as well defined as possible. Care must be taken to make it behind that portion of the cornea which is most transparent and least altered in curvature, the best situation being ascertained by oblique illumination. The new pupil must not be made upwards, or it will be covered by the upper lid.

Methods of making artificial pupil.

An artificial pupil can be made in any of the following ways:—(1) By incision of the iris. (2) By tearing it away from its insertion. (3) By excision of a portion (iridectomy for artificial pupil). (4) By ligature.

For the performance of operations for artificial pupil the position of patient and Surgeon should be the same as for that of "iridectomy," and an anæsthetic should be administered.

Incision.

I (*a*). *Incision* (Fig. 91 A).—This operation is called for in cases of complete closure of the pupil, following removal of the lens, either by operation or injury. In these cases the iris may be found changed into a tense unyielding membrane, which cannot be seized with forceps; the operation is not advisable unless the lens is absent.

The operation of "incision" may be performed either by thrusting a broad needle through the cornea near its margin, and then incising the iris, so as to cut across its radical fibres; or an incision having been made with an iridectomy knife in the sclero-corneal margin, a pair of scissors (having one sharp and one blunt-pointed blade) may be introduced through the wound, one blade being thrust through the iris at its nearest point and passed behind it, the other carried along its anterior surface, the iris being then cut fairly across from one side to the other.

Whichever plan of incision is adopted, the vitreous humour pushes forward into the wound and keeps its edges widely separated, a pupil resembling Fig. 91 A being formed.

Iridotomy.

Two other methods of making an artificial pupil by "incision" have been lately introduced; they are known as single and double "iridotomy."

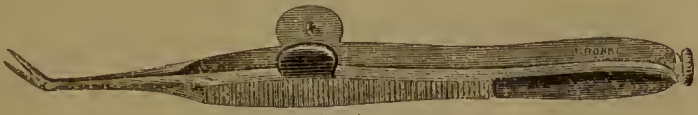
For the positions of patient and Surgeon in performing either of these operations *see* Fig. 83, p. 330.

(*b*). *Single iridotomy* should be thus performed:—The eyelids being kept open with the wire speculum, and the eyeball fixed by seizing the conjunctiva and subconjunctival fascia, close to the margin of the cornea at its inner side, an incision should be made with an iridectomy knife in the cornea, about midway between its margin and the pupil, and opposite to the point of fixation with the forceps. The forceps scissors (Fig. 90) must be then introduced closed through the wound into the anterior chamber, the blades opened, one passed through the pupil behind the iris, the other on its anterior surface; the

Wecker's scissors.

sphincter of the pupil should then be divided with one sharp cut; the scissors withdrawn, any prolapse of iris that follows replaced with the curette, a drop of atropine should be placed between the lids, and the eye lightly bandaged.

Fig. 90.



Wecker's scissors.

This operation is applicable to cases where the lens is present, its centre being opaque and its peripheral portion clear.

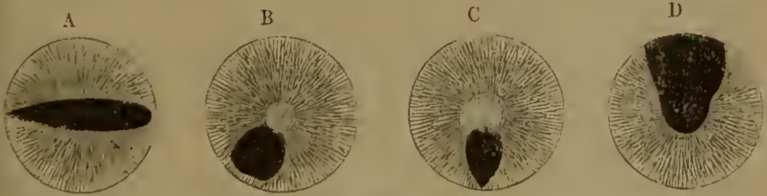
Double iridotomy.

Escape of vitreous.

(c). *Double iridotomy* is applicable to cases of closed pupil after cataract extraction. An incision should be made straight down upon the cornea at its upper part, the knife being carried through the iris and along its posterior surface, so as to make a fair-sized wound in it; the incision being finished, the knife should be carefully withdrawn, and, very possibly, some vitreous humour will follow it.

The next step in the operation should be to pass the scissors forceps, closed, through the wound in the cornea into the anterior chamber, open them, pass one blade behind the iris, the other in front of it, make an incision in a direction downwards and inwards; then change the direction of the scissor blades and make a cut downwards and outwards. Thus a small piece of iris is enclosed by a V-shaped incision, the apex of the V being upwards. The small portion of iris contracts up, and a somewhat triangular pupil is left. The eye should be bound up as usual.

Fig. 91.



A. Pupil after incision. B. Pupil after excision. C. Pupil after ligature. D. Iridectomy for glaucoma, &c.

Iridodyalisis.

(2) **Tearing away the iris from its insertion (Iridodyalisis).**—An incision having been made in the cornea on the side opposite to that on which the iris is to be removed, a pair of iris forceps should be passed through the wound and across the anterior chamber; the iris seized close to its greater circumference, and torn forcibly away from its insertion; the instrument should then be carefully withdrawn and the eye bound up. If necessary, the whole iris may be removed in this way. The operation is applicable to cases of dense corneal opacity (leucoma), occupying the whole of its central part, some transparent cornea being left at the margin.

Iridectomy for artificial pupil.

(3) **Excision—Iridectomy for artificial pupil.**—An incision should be made of the requisite size, at some part of the sclero-corneal margin; the iris forceps introduced through the wound, the ends of

their branches passed fairly up to the margin of the pupil; the iris seized and drawn out through the wound, and a small portion removed with scissors. The curette should then be passed between the lips of the wound so as to push back any portion of iris that may have become entangled in it; a pupil resembling Fig. 91 B should be formed.

Iridesis.

(4) **By ligature (Iridodesis, or Iridesis).**—An incision should be made with a broad needle near the margin of the cornea, a small noose of silk laid upon the surface of the eyeball so as to encircle the incision; an iris hook or cannlar forceps then passed through the noose and wound, and the iris drawn gently out; an assistant with two pairs of broad-ended forceps should seize each end of the noose and firmly ligature the included portion of iris; the ligature will drop off in the course of a few days, a pupil resembling in shape Fig. 91 C being left.

THE CRYSTALLINE LENS.

Cataract.

By cataract we understand an opacity situated in the crystalline lens.

Causes of cataract.

The causes of this opacity are somewhat obscure, but probably depend on impairment of nutrition of the lens consequent on senile decay or general constitutional conditions (*e.g.* diabetes).

It also occurs in connection with inflammatory changes in adjacent parts—the choroid, ciliary body, vitreous, and iris; is met with as a congenital defect, and very frequently results from injury.

Forms of cataract.

Forms of Cataract.

There are two principal forms of cataract:

(1) *The cortical or soft cataract.*

(2) *The nuclear or hard cataract.*

In the first form the cortical substance of the lens is primarily affected, the nucleus afterwards becoming opaque, the whole being soft, or even fluid.

In the second the nucleus of the lens first becomes hard, yellowish, and opaque, the cortical substance being subsequently affected.

Cortical cataract.

The cortical cataract is met with as an idiopathic disease in childhood and early adult life, and as the result of injury at all ages.

There are several varieties of cortical cataract.

Zonular cataract.

(*a*) *Zonular or lamellar cataract* is either congenital or commences soon after birth; it is characterised by the occurrence of an opacity of quite circular form and well-defined outline, situated in the cortical substance of the lens, but at some distance from its surface; the margin and superficial layers of the lens are transparent.

(*b*) *Ordinary congenital cataract* is a bluish-white opacity of the whole lens.

Traumatic cataract.

(*c*) *Traumatic cataract* is an opacity of the lens often accompanied by swelling, caused by rupture of its capsule from injury, and subsequent action of the aqueous humour upon its substance.

Posterior polar cataract.

(*d*) *Posterior polar cataract.*—An opacity situated at the posterior pole of the lens; and—

Diffluent cataract.

(*e*) *Entirely fluid or diffluent cataract* is caused by changes in the lens, secondary to inflammation of adjacent parts.

(*f*) The variety of cataract met with in diabetes is composed principally of soft material; but if the patient be advanced in years there is usually a hard nucleus.

Nuclear cataract occurs in persons who have passed the middle period of life, and is characterised by the presence of a hard yellowish central portion or nucleus of varying size and density; the nucleus is surrounded by more or less soft cortical substance, and is occasionally of a greenish, or almost black colour, giving rise to what is known as *green or black cataract.*

Nuclear cataract.

Black cataract.

Diagnosis of cataract.—The existence of cataract is easily ascertained by oblique illumination, the pupil having been dilated with atropine previous to making the examination.

Diagnosis of cataract.

TREATMENT.—The treatment of cataract is entirely operative, no kind of medication being of the least use.

Treatment.

Our object in performing an operation is to open a path for rays of light to pass to the retina.

The object can be attained in one of two ways, the method adopted depending on the kind of opacity present.

(1) In cases (as lamellar cataract) where the bulk of the lens is clear, the opacity being situated in the axis of the normal pupil, very useful vision is procured by making an artificial one, opposite a transparent portion of the lens (*see* Artificial Pupil).

(2) In cases of opacity involving the whole lens its entire removal must be accomplished.

Three varieties of operation are performed to secure the removal of the whole lens:

Varieties of operation.

(1) The operation for solution or absorption.
(2) Extraction.
(3) Suction.

Forms of cataract to which each operation is applicable.—As a broad rule, cataract occurring in persons below twenty is of the soft or cortical form, and should be removed by *solution* or *suction;* cataract occurring in people above thirty (excepting traumatic cataract) is of the hard or nuclear form, and must be removed by extraction.

Forms of cataract to which each is applicable.

In the intermediate decade a doubt may arise as to what is the best plan of procedure; in these cases the Surgeon must be guided by the general appearance of the cataract; if it appear bluish in colour, and somewhat swollen, it is probably soft and can be removed by *solution* or *suction;* if there is a distinct yellow reflection from its centre, denoting the presence of a hard nucleus, it should be removed by *extraction.* It must also be borne in mind that loss of time is a very serious consideration with most patients, consequently a preference must always be given to that operation which will allow him to resume his occupation as early as possible.

Solution, though somewhat safer than extraction, is always a tedious process, and the more so the older the patient; consequently, preference must be given to extraction in all cases where the condition of the patient's sight is such as to prevent him from following his occupation, even though there be no appearance of a hard nucleus. In cases where the cataract is evidently soft, and one eye retains useful vision, solution is to be preferred to extraction, as the patient can continue at his work during the time that absorption is going on.

Before performing any operation for cataract we must take care to ascertain that the eye has good perception of light, indicating that the retina is in a normal condition; otherwise, no improvement of vision will result from removal of the lens.

Operations for Removal of Cataract.

Solution.

Solution.—The object of the operation for solution is to open the lens-capsule, and thus allow its substance to be acted upon by the aqueous humour, by which it is broken up and softened, absorption finally taking place.

The operation can be performed as follows (for the positions of patient and operator *see* Fig. 83, p. 330):—No anæsthetic is needed; the pupil should be well dilated with atropine; the operator, keeping the eyelids separated by the fore and ring fingers of one hand, and steadying the globe by pressing the second finger gently upon it, should take a cataract needle in the other hand and pass it obliquely through the cornea at such a distance from its centre that any resulting cicatrix shall not interfere with vision; the needle should then be pushed on across the anterior chamber into the area of the pupil; its point then depressed and three or four incisions made with it in the lens-capsule, so as to divide it freely. Care must be taken to use the needle very gently, and not to pass it too deeply into the lens, otherwise the suspensory ligament may be torn and the lens displaced.

Precautions to be taken.

The capsule having been freely divided, the needle should be carefully withdrawn and a drop of solution of atropine placed between the lids; the only after-treatment required is the constant use of atropine, so as to keep the pupil widely dilated.

If the eye be examined in the course of a few days white flocculent lens matter will be seen protruding through the opening in the capsule into the anterior chamber, showing that the lens is swelling and undergoing solution.

Operation requires to be repeated.

The operation will probably require to be repeated in about a month or six weeks, and possibly on one or two subsequent occasions, before the whole lens is absorbed. Care must be taken not to do too much at one sitting, or the lens may swell too rapidly and press upon the surrounding parts, giving rise to severe pain, increased tension of the globe, iritis, cyclitis, &c.

Extraction of cataract.

Extraction of cataract.

The object of operations for extraction of cataract is the removal of the lens through an incision altogether in the cornea or partly in the sclero-corneal margin or sclerotic, the incision being either simple or associated with excision of a portion of iris.

Extraction can be best performed by one of the four following methods:—(1) Flap extraction, (2) extraction by oblique corneal section, (3) linear extraction, (4) extraction by means of a traction instrument. In the first two methods no iris is removed; in the last two iridectomy should be performed at the time of removal of the lens or some months previously. All entirely opaque lenses (mature cataracts) should be removed by one of the two first methods; all partially opaque lenses (immature cataract) by the third, a traction instrument being used in cases where great difficulty is encountered in removal, or where escape of vitreous has taken place before the lens has been extracted.

Flap extraction.

Flap extraction.

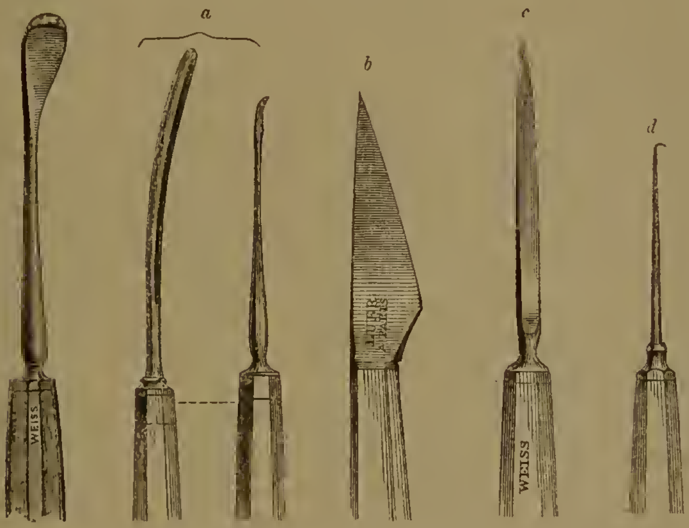
The instruments required for flap extraction are a triangular cataract knife, sharp hook, and curette (Fig. 92 *b*, *d*, *a*).

For the positions of patient and operator *see* Fig. 83, p. 330. No anæsthetic is required; the patient should be requested to look downwards; the lids should be kept open and the eyeball steadied by the operator's fingers as in the operation for solution.

Method of making section.

The incision should be made by passing a triangular cataract knife through the outer margin of the cornea, at a point just above its horizontal meridian, into and across the anterior chamber, bringing it out through the cornea at a corresponding point on the inner side, and completing the section by pushing the knife onwards until its heel cuts out along the upper margin of the cornea. (Fig. 93 A.)

FIG. 92.

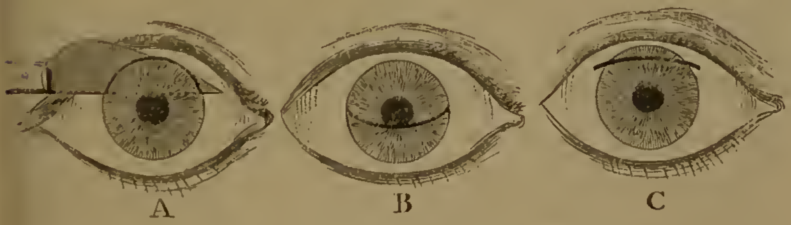


Extraction instruments.

Instruments for extraction of cataract.
a. Curette and pricker. *b.* Triangular cataract knife. *c.* Straight cataract knife.
d. Sharp hook. *e.* Scoop.

This simple onward movement of the knife is sufficient if the incision has been properly planned, but should the cornea have been entered too low down, the knife will not be wide enough to cut out, and then the section must be completed by slightly withdrawing the blade or by a sawing movement. Care must be taken not to withdraw

FIG. 93.



Incisions for extraction.

Incisions for extraction of cataract.—A. Flap. B. Oblique corneal section.
C. Linear incision.

the knife until it has passed some distance through the opposite side of the cornea, or the aqueous humour will escape too soon, and the iris fold over the edge of the knife and be wounded.

If the incision has been properly made a semicircular flap, including a little less than half the cornea, will be formed.

The section having been finished, the patient should close the eyes gently, and be allowed to rest for a moment.

Removal of the cataract.

The next step in the operation is the removal of the opaque lens. The upper lid being drawn gently upwards and the patient directed to look downwards, the sharp hook must be introduced through the wound and the lens capsule lacerated by gently scratching it; the hook should then be withdrawn, and the patient allowed to close the eyes for a short time.

The eyes should then be gently opened, and the lens removed by gently pressing the lower lid against the globe, just below the lower margin of the cornea, with the thumb of one hand, counter-pressure being similarly applied with the forefinger of the other hand at a corresponding point above. If the manœuvre be properly executed the pupil gradually dilates, the lens slips gently through it into the anterior chamber and then escapes by the corneal wound. Any prolapse of iris that may occur must be carefully returned with the curette; each eye should then be covered with two pieces of wet lint and a light bandage applied.

Oblique corneal section.

Oblique corneal section.

This operation often goes by the name of Bader's or Liebreich's operation, when the section is made downwards; Lebrun's "extraction by small median flap," when the section is made upwards. It seems to me that the term "oblique corneal section" expresses all and dispenses with much unnecessary prolixity.

The instruments required are a thin straight cataract knife, a sharp hook, and curette (Fig. 92 *c*, *d*, *a*). (For the position of patient and Surgeon *see* Fig. 83, p. 330.) No anæsthetic is required, and, with the exception of the incision, the steps of the operation are much the same as in that of flap extraction.

Method of making incision.

The incision may be made either upwards or downwards (Fig. 93 B), by passing the straight knife through the sclero-corneal margin on the outer side at a point (puncture) corresponding to the horizontal corneal meridian into and across the anterior chamber, out at a corresponding point on the inner side (counter-puncture), and then cutting forwards by a sawing movement, *obliquely*, through the cornea, midway between the pupil and upper or lower corneal margin; the former if the incision is made upwards, the latter if it is made downwards. In entering the knife and passing it across the anterior chamber, care must be taken to keep its edge directed forwards towards that part of the cornea which it is desired to incise; if the knife be rotated in any way after the anterior chamber has been opened, the aqueous humour will escape and the blade become entangled in the iris.

The capsule should be lacerated and the lens removed in the same way as in flap extraction; the position of the incision near the centre of the cornea, however, will not allow the lens to be pressed out immediately, as is done in the flap operation.

Removal of the cataract.

Before attempting to squeeze out the cataract its margin must be brought opposite the incision by gently pressing upon the globe above or below, according as the section has been made upwards or downwards.

Treatment of soft matter.

The bulk of the cataract having been removed, care must be taken to get away any soft cortical substance or fragments of lens that may be left. The soft matter can be removed by gently rubbing the cornea; small hard fragments must be drawn out by the curette or a small scoop. The whole of the cataract having been removed, the iris, which will in all probability have somewhat prolapsed, must be replaced with the curette, both eyes being then carefully bandaged.

Linear extraction.

Linear extraction.

In this operation the cataract is removed through a linear incision, partly in the sclerotic and partly in the cornea, or altogether in the latter; usually associated with iridectomy, performed at the time of extraction of the cataract, or some months previously.

What is generally understood as linear incision is an incision made in the same direction as a straight line drawn from the centre of the cornea to its circumference (one of its radii). Many modifications of linear incision are practised, but only one will be described here.

Instruments required.

The instruments required for linear extraction are a wire speculum (Fig. 86), toothed forceps (Fig. 88*a*), a straight cataract knife, a curette, sharp hook (Fig. 92 *c*, *a*, *d*), iris scissors, and iris forceps (Fig. 89 *b*, *c*).

Employment of anæsthetic.

Method of making incision.

The operation should be performed thus, and, as in the oblique corneal section, the incision may be made either upwards or downwards (for position of patient and operator *see* Fig. 83, p. 330):—The patient should be thoroughly anæsthetized, the lids kept open by a wire speculum, and, supposing the incision to be made upwards, the globe must be drawn gently downwards with the toothed forceps, holding the conjunctiva and subconjunctival fascia close to the lower margin of the cornea; then with the straight cataract knife puncture and counter-puncture should be made in the *sclerotic*, just beyond the sclero-corneal margin, the knife entering at a point on the outer side of the globe, situate in a line about midway between the horizontal meridian of the cornea and its upper margin, and emerging at a corresponding point on the inner side; the edge of the knife should be kept directed nearly straight forwards, and by a sawing movement made to cut its way out through the cornea, at a short distance from its upper margin. (Fig. 93 C.)

If iridectomy has not been previously performed, a piece of the iris should now be excised from the upper segment. (*See* Iridectomy.)

Laceration of capsule.

The next step is to lacerate the capsule. The operator should fix the eye, and draw it gently downwards with the toothed forceps, then introduce the sharp hook through the incision and freely lacerate the capsule with it. The cataract can then be removed by making gentle pressure with the curette upon the eyeball, near the lower margin of the cornea, the globe being steadied and held in position by fixing the conjunctiva with the toothed forceps.

Removal of soft matter, &c.

The nucleus and bulk of the cataract having escaped, the curette should be passed gently over the surface of the cornea from all directions towards the incision, so as to press out any cortical substance that may be left, and if any blood or portions of lens remain in the incision they must be carefully removed, so as to insure perfect coaptation of its margins; the speculum should then be removed, and both eyes bandaged in the usual way.

The incision for linear extraction, as already stated, may be made downwards as well as upwards, the former method of operating being much the easier, and not requiring the aid of an assistant.

The same objections apply to extraction downwards as to iridectomy in the same direction, but the results obtained are equally as good as those from upward sections, and the ease with which the operation can be performed quite counter-balances any objections which may be made on the score of disfigurement.

Extraction by traction.

Extraction of cataract by a traction instrument.

Cataract can be removed by a traction instrument, either through a flap section or peripherally situated linear incision, iridectomy being performed in either case.

The patient should be thoroughly anæsthetized, and, whichever incision is made, the eyelids should be kept open with the speculum, and the globe fixed with the toothed forceps, both during the section and subsequent removal of the lens.

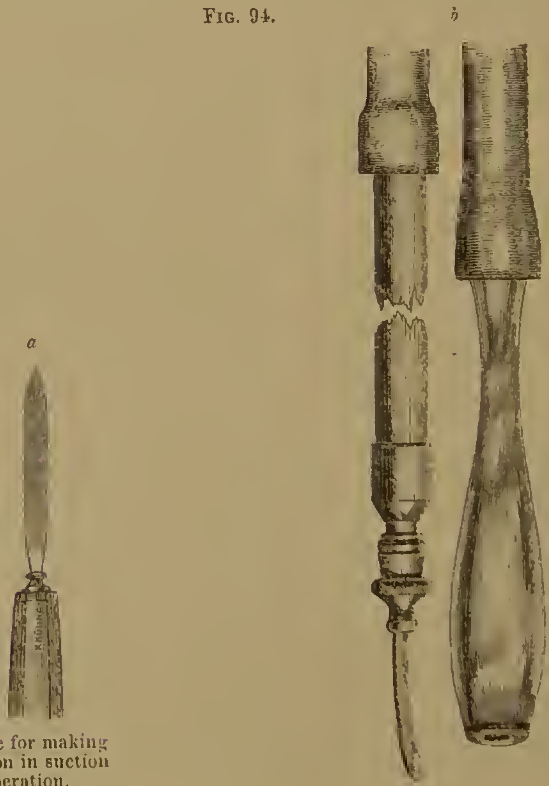
The traction instrument employed is either a scoop or a sharp hook (Fig. 92 *e*, *d*).

Scoop extraction.

Removal of cataract with the scoop (scoop extraction).

Scoop extraction can be accomplished thus:—The section having been made and iridectomy performed, the convex surface of the scoop should

FIG. 94.



Needle for making incision in suction operation.

Suction tube.

be pressed gently upon the more peripheral margin of the incision, so as to cause it to gape somewhat; then passed with the utmost gentleness through the incision, beneath the margin of the lens, along its posterior surface and beyond its posterior pole, until the lens lies well in the concavity of the instrument. The scoop must then be carefully withdrawn, carrying the cataract with it, the removal being assisted by gentle pressure on the exterior of the globe.

Sharp-hook extraction.

Removal of cataract with the sharp hook (sharp-hook extraction).

The hook should be passed well behind the lens in the same manner as the scoop, fixed into its posterior surface, and then carefully withdrawn, carrying the lens with it. Two sharp hooks may be used instead of one, and should be fixed into the lens at different points, so as to prevent it rolling round (as is sometimes the case when only one hook is used), instead of passing in the desired direction.

After removal of the lens by either method both eyes should be bound up in the usual way.

Suction.

Suction.—The removal of cataract by suction is indicated in cases where the lens has become nearly or entirely fluid, as occurs in many cases of traumatic cataract, and frequently after a needle operation has been performed.

Instruments required.

The instruments required are a wire speculum, toothed forceps, broad needle, and suction tube (Figs. 86, 88*a*, 94 *a*, *b*). Before operating, the pupil should be well dilated with atropine. (For position of patient and Surgeon *see* Fig. 83, p. 330.)

It is best, but not absolutely necessary, to place the patient under the influence of an anæsthetic. The lids should be kept open by a wire speculum, the eyeball fixed by the toothed forceps, and a somewhat linear incision made in the cornea with the broad needle, about midway between its summit and margin, in any convenient position.

Method of using suction tube.

The operator should then place the mouth-piece of the suction tube in his mouth, pass its nozzle through the incision and behind the softened lens, and then, by sucking gently, remove as much lens matter as will come away easily. No force must be used, and if any portion of the lens be too hard to pass easily into the tube it may be left to become absorbed or be dealt with on a future occasion. When as much lens as will easily come away has been extracted the suction tube should be removed, the speculum taken out, a drop of solution of atropine placed between the lids, and the eyes bandaged in the usual way. The bandage should be continued, and the pupil kept dilated with atropine, until all irritation has subsided.

Accidents during Extraction of Cataract.

Accidents which may happen.

Premature escape of aqueous humour.

If care be not taken in making the section the aqueous humour may escape too soon, and the movements of the knife be hampered by the iris falling forwards. Should this happen, the knife must be carefully withdrawn and the section completed with scissors.

Bleeding into anterior chamber.

Bleeding into the anterior chamber.

In some cases hæmorrhage from the cut iris takes place to such an extent as to fill the anterior chamber with blood and hide the cataract entirely from view.

If the blood does not flow out easily on placing the curette between the lips of the incision and making gentle pressure on the cornea (unless the lens-capsule has been lacerated), the operation should be discontinued, the eye bound up, and left till the blood has become absorbed. But if the capsule has been opened the lens *must be removed at all risks*, or it may swell, press upon surrounding parts, set up inflammatory action, cause increase of tension of the globe, and very probably lead to destruction of the eye.

Prolapse of vitreous.

Prolapse of vitreous humour.

If any undue pressure be exerted on the globe during extraction the suspensory ligament of the lens gives way and a prolapse of vitreous follows. Should the prolapse of vitreous occur before the escape of the lens the cataract should be removed as quickly and gently as possible by the aid of a scoop or sharp hook.

Prolapse of vitreous is more likely to occur if the humour is abnormally fluid. The accident may give rise to no bad results, but is sometimes followed by a form of chronic choroiditis which ultimately destroys the eye.

If vitreous has been lost great care must be taken to bandage the eye so as to keep the lids immovable and prevent them pressing upon the globe and causing further prolapse.

Displacement of the cataract.

Displacement of the cataract.

In some cases, on an attempt being made to press out the lens, the suspensory ligament gives way, and the cataract, instead of coming forwards into the anterior chamber, passes behind the iris or sinks backwards into the vitreous chamber; it must, if possible, be removed by the scoop or sharp hook. If left within the globe it will probably act as a foreign body, set up an inflammation, and destroy the eye.

After-treatment.

After-treatment of Extraction of Cataract.

Immediately after the operation each eye should be covered with two folds of wet lint secured by a piece of bandage. The patient should then be put to bed, where he should remain for three or four days.

The lint must be kept constantly wet, and fresh pieces should be applied every two or three days.

Condition of eyelids.

On no account should the eye be examined until the end of the first week; if the lids remain in a normal condition we may rest assured that all is going on well, and opening the eye too early can do no good, and may do a great deal of harm.

Bandage may be removed.

At the end of a week the eye may be opened and its condition ascertained. Should the section be healed, the anterior chamber re-established, and no signs of inflammatory action be present, the sound eye can be safely left uncovered, the one that has been operated on being kept bandaged as before, and a large green shade worn over both. At the end of three weeks the bandage may be removed from the eye on which extraction has been performed, but the shade or protectors should be worn until all undue vascularity has subsided.

Glasses may be ordered.

At the end of about two months (if there be no intolerance of light or irritability of the eye) glasses should be ordered, two pairs being given; one for going about, and one for reading; convex 3 will usually be found most suitable for the former purpose, convex 2½ for the latter.

But should the patient have been myopic or hypermetropic before the operation, glasses weaker or stronger than these may be required.

This is the usual course of cases of extraction of cataract; all do not, however, go on so favorably.

A day or two days after the operation the patient may complain of severe pain in the eyeball, temple, and brow; on removing the bandage the lids may be found puffy and red, or perhaps much swollen.

Symptoms of inflammation.

These symptoms always indicate inflammatory changes of some of the ocular structures; the inflammation may be simply an attack of iritis, which will probably proceed to a favorable termination; or the choroid may become subsequently affected, a chronic form of choroiditis being set up, which leads to softening, and eventually to shrinking of the globe; the cornea may be inflamed or suppurating, or inflammation and suppuration of all the ocular structures (panophthalmitis) may have set in. For the treatment of these cases *see* Iritis, Corneitis, &c.

Occurrence of entropion.

A not uncommon cause of pain and irritation is the occurrence of entropion of the lower lid; this must be remedied by operation (*see* Operations on the Eyelids).

Causes of Unsatisfactory Results of Cataract Extraction.

Closure of pupil.

The result of an operation for extraction of cataract may be marred by closure of the pupil consequent on iritis, by obstruction of its area with opaque lens capsule, or by opacity of the vitreous humours.

Capsular obstruction.

Occlusion of the pupil should be remedied by making an artificial one (*see* Artificial Pupil); capsular obstructions must be torn through with cataract needles, cut across with scissors, or removed bodily with forceps.

The greatest caution must always be exercised in meddling with opaque capsule, as an operation upon it, especially an attempt to tear it forcibly away, is very likely to be followed by increase of tension, inflammation, or even suppuration of the eyeball.

Opacity of vitreous.

For opacity of the vitreous humour nothing can be done.

EXTIRPATION OF THE EYEBALL.

Extirpation of eyeball.

Removal of the eyeball is called for under the following conditions:

Cases in which the operation is called for.

(1) In all cases of injury causing complete disorganization, with collapse of the globe and escape of its contents.

(2) In cases where one eye, having been damaged by injury or disease to such an extent as to render it *practically useless*, becomes irritable or painful, and the sound eye appears threatened by sympathetic ophthalmia.

(3) In cases where an eye having been lost, from injury or disease, *being quite blind*, becomes a source of annoyance, though the other eye be not threatened.

(4) In cases where the globe has become the seat of malignant disease.

Operation of extirpation.

Extirpation of the eyeball can be thus performed (for position of patient and operator *see* Fig. 83, p. 330):—The instruments required are a wire speculum, toothed forceps, a pair of blunt-pointed scissors, curved on the flat (Fig. 95) and a strabismus hook. The patient being thoroughly under the influence of an anæsthetic, the operator should place the wire speculum between the lids, then by the aid of the forceps and scissors cut through the conjunctiva all round the cornea and as close to its margin as possible; he should then, with the stra-

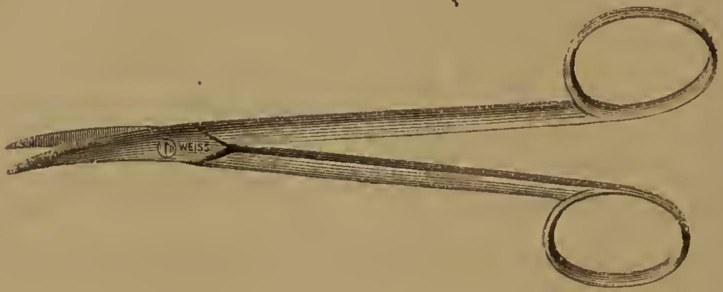
Division of the conjunctiva.

Division of the muscles.

bismus hook, take up the four recti muscles, one after the other, and divide them with the scissors, either the external or internal rectus

Fig. 95.

Extirpation scissors.



Extirpation scissors.

being divided at a little distance from the globe, so as to afford a hold for the forceps in the subsequent steps of the operation; the other three muscles should be cut as close as possible.

The muscles having been divided, the hook should be made to sweep round the globe, so as to be sure that nothing is left uncut. The speculum should then be pressed backwards, and the eyeball will become dislocated in front of the lids; the globe should then be steadied by seizing the piece of muscle purposely left, with the forceps, the scissors passed behind it until their points are found to be in contact with the optic nerve, then slightly withdrawn, opened widely, pressed forwards again, and the nerve divided by a single cut.

Division of optic nerve.

As soon as the nerve has been cut through, the eyeball will be set almost free, being held only by the oblique muscles: these should be then divided close to the sclerotic. The speculum may then be removed, or left between the lids; in either case a piece of sponge should be pressed firmly into the orbit, and secured by a turn of bandage; the sponge should be left till bleeding has ceased, then removed with the speculum if it have been left, and wet lint and a bandage applied. In about three weeks or a month an artificial eye may be ordered.

Artificial eye.

Abscission.

ABSCISSION.

The object of the operation of abscission is the removal of that portion of the eyeball (including the ciliary region) situated in front of the attachments of the recti muscles, these being left intact. By this means a movable stump is left, on which an artificial eye can rest and be moved in harmony with the movements of the sound eye.

Cases to which it is applicable.

The performance of abscission is indicated in cases of staphyloma occupying the whole or greater part of the former situation of the cornea, the remainder of the globe retaining its normal curvature.

The operation.

The operation may be thus performed (for position of patient and operator *see* Fig. 83, p. 330):—The instruments required are a wire speculum, toothed forceps, strabismus scissors, a triangular cataract knife, a curved needle and silk. The patient being thoroughly under the influence of an anæsthetic, the wire speculum should be placed between the lids, the conjunctiva divided all round close to the corneal margin (as for extirpation), and dissected back to the desired extent.

Then with the curved needle a single suture should be passed through the inner and outer margins of the divided conjunctiva, and the silk left hanging in a large loose loop on the patient's face.

The staphyloma, the whole of the ciliary body, and sclerotic corresponding to it, should then be removed by transfixing the globe with a triangular knife just in front of the insertions of the internal and external recti muscles, cutting out upwards in front of the insertion of the superior rectus, and finishing the removal by a sweep of the knife in the opposite direction.

The silk should be then drawn up and tied, by which means the conjunctiva will be made to cover the wound in the globe, and wet lint and a bandage applied. As soon as the parts have firmly healed an artificial eye may be worn.

AFFECTIONS OF THE ORBIT.

Protrusion of the Eyeball; Inflammation and Suppuration within the Orbit; Hæmorrhage into the Orbit; Vascular Protrusion of the Eyeball; Tumours of Orbit, Orbit and Eyeball, Eyeball alone; Suppuration of Eyeball.

Protrusion of the eyeball.

Protrusion of the eyeball.—As many of the diseases of the orbit and, to a considerable extent, tumours of the eyeball itself cause more or less protrusion of the globe, it will be well to say a few words on this subject before describing the morbid changes which may give rise to it.

Causes.

The symptoms are obvious enough, and do not require description. The causes are the following:

1. Inflammation within the orbit, either without or with the formation of abscess.
2. Hæmorrhage into the orbit and vascular protrusion of the eyeball.
3. In the disease known as exophthalmic goitre the eyes assume a very unnatural prominence.
4. Tumours affecting the orbit, exostoses, malignant growths, cysts, nævi, &c.
5. Enlargement of the eyeball itself from (*a*) growths, malignant or simple; (*b*) inflammation and suppuration of the whole eyeball (ophthalmitis).
6. Another cause of protrusion of the eyeball is paralysis of its muscles, allowing the globe to drop forwards, and thus assume an unusual prominence.

Ill effects of protrusion.

Double vision is *generally* complained of in protrusion of the eyeball. The ill effects of the abnormal position are seen both in the globe itself and in the lids. Should the protrusion be so great that the lids cannot be closed over the eyeball the cornea will be left unprotected and may become opaque, and afterwards ulcerate or slough. If the protrusion continue for long, the lids become distended and flaccid, their movements being much impaired; the tear puncta may also become displaced, giving rise to continual watering of the eye.

Treatment.—In all cases where the eyeball is healthy care must be taken to protect the cornea from injurious exposure, by drawing the lids over it and keeping them fixed by means of a compress and bandage, or in extreme cases the edges of the lids must be made raw, their margins united by sutures, and allowed to heal firmly together.

Inflammation within the orbit.

Inflammation within the orbit.

Inflammation may affect the soft tissues within the orbit, the periosteum, or the bone itself; it may end in resolution, the parts returning to their natural condition; chronic thickening may result, causing more or less permanent protrusion and impairment of the movements of the eyeball. Abscess may form, and in the case of periostitis or ostitis caries and necrosis of the bony walls may supervene.

Symptoms.

Causes.

SYMPTOMS.—Inflammation within the orbit is accompanied by more or less constitutional disturbance of a febrile nature, pain of a throbbing character much increased by pressure, some swelling of the conjunctiva and lids, more or less prominence and impairment of movements of the eyeball, intolerance of light, and watering of the eye; it may be the result of cold, injuries, or general diseases, as erysipelas, and (in the case of periostitis) of syphilis, or may come on in debilitated states of the system, as during recovery from acute diseases (scarlet fever, measles, &c.), or from over-lactation. It is not easy to distinguish inflammation affecting the soft parts only from inflammation of the periosteum or of the bone.

Treatment.

TREATMENT should consist in allaying pain and inflammation by means of opium internally, fomentations of poppy-heads applied to the affected part, leeches to the corresponding temple (two to six in number), and rest in bed in a darkened room; any general medical treatment which may appear most applicable should also be employed.

For instance, if the patient be strong and healthy, low diet, purgatives, &c., should be had recourse to; if weakly, as during recovery from some acute disease, tonics and good diet should be prescribed. Should the patient be the subject of syphilis this should be treated.

Abscess.

Should the inflammation go on to the formation of abscess, the symptoms are aggravated, the conjunctiva becomes more swollen, and in some cases almost covers the cornea, the lids will be greatly swollen and red, the prominence and impairment of movement of the eyeball will be increased, and rigors may occur. Vision will be misty, and in some cases all perception of light may be entirely lost. After a time fluctuation may be detected; if left to itself, the abscess will burst, the pus being discharged either through the skin or conjunctiva. The abscess having been emptied, in favorable cases the swelling disappears, the eyeball resumes its natural position, and the opening heals. But in some cases, especially if the suppuration be associated with caries and necrosis of the bone, the abscess remains open, or the orifice alone heals, the sac of the abscess again becoming filled with pus.

Treatment.

TREATMENT.—As soon as the Surgeon feels satisfied of the existence of pus in the orbit it should be evacuated; if he can detect fluctuation the diagnosis is easy enough, but if this cannot be done, and the existence of pus is suspected, an exploratory puncture should be made, when the escape of pus will clear up any doubt.

Hilton's method of opening abscess.

The best method of opening an abscess in the orbit is that recommended by Mr. Hilton for evacuating pus situated at a depth from the surface amongst important structures. The operation should be performed as follows:—An incision having been made, either through the skin or conjunctiva, at that part where the eyeball appears most thrust away from the wall of the orbit, a grooved director should be thrust in (the Surgeon bearing in mind the direction of the wall along which he is passing the instrument and the depth of the orbit). As soon as pus is seen escaping along the groove of the director a pair of small dressing forceps should be passed along it until their points are within the abscess; the blades should then be separated slightly and drawn out whilst so separated; a ragged opening will thus be left, which is not likely to close too soon, and the danger of cutting important structures will be obviated.

The greatest care must always be taken not to injure the eyeball. As the operation is very painful, an anæsthetic should be given.

Immediately after the operation search should be made by means of a probe for pieces of diseased bone or foreign bodies; if a foreign body be detected it must be at once removed; diseased bone may be left to itself, and will either come away spontaneously or may require removal at a later period. If the opening appear inclined to close too soon it should kept open by means of a piece of lint passed into it; only light water dressings need be applied.

Periostitis or ostitis followed by caries and necrosis of the walls of the orbit.

Periostitis ostitis.

Symptoms.

Symptoms.—The symptoms of periostitis or ostitis going on to suppuration and caries and necrosis are similar to those above described, excepting, perhaps, that the pain is more severe and often aggravated at night. This form of inflammation should always be suspected in persons suffering from syphilis, and occasionally nodes may be met with at the margin of the orbit or in the forehead; their existence should always lead the Surgeon to suspect that the inflammation within the orbit is periosteal. When the abscess has formed and burst, or has been opened, the seat of inflammation becomes evident from the character of the pus, which is of that peculiar unhealthy and bad smelling variety met with in abscesses connected with diseased bone; from the condition of the opening, which remains patent and is surrounded by large unhealthy graunlations, and from the fact that the bare bone can be felt with a probe passed through the opening.

Terminations.

Caries and necrosis usually end in recovery after a time, the diseased bone being thrown off and the sinus becoming closed. The disease generally attacks the margin of the orbit and often leaves cicatrices, which cause great disfigurement and deformity of the eyelid. Should caries and necrosis occur deeply in the orbit the results may be most serious, the optic nerve becoming affected and vision lost, or the disease may spread to the interior of the skull, set up meningitis, and cause death.

Treatment.

Treatment.—In the earlier stages the treatment should be the same as that described under inflammation and abscess of the orbit, but when the abscess has burst, or been opened, its cavity should be syringed but daily with some mild disinfecting solution; care must be taken to prevent its too early closure, by means of a piece of lint pushed into the sinus; exuberant granulations should be kept down by the application of nitrate of silver, and distortion of the lids, if likely to occur, must be prevented by uniting their edges (*see* Operations on the Eyelids).

Removal of dead bone

If any pieces of bone are found loose they should be removed by operation.

Hæmorrhage into the orbit.

Orbital hæmorrhage. Spontaneous.

Orbital hæmorrhage may depend upon the spontaneous rupture of a vessel within the orbit. Should the bleeding be considerable, displacement of the eyeball may occur. The blood may become diffused, and appear beneath the conjunctiva, being subsequently gradually removed by absorption. But occasionally the clot becomes encysted, and permanent displacement of the eyeball results. Hæmorrhage into the orbit also frequently occurs in fracture of its walls, blood being effused to a considerable extent; subconjunctival ecchymosis may be a prominent symptom in some cases of fracture of the base of the skull extending through the roof of the orbit. Hæmorrhage sufficient to cause displacement of the eyeball has occurred after the operation for strabismus.

From injury.

Treatment.

TREATMENT.—In cases of spontaneous hæmorrhage light pressure should be applied to the eye by means of a pad of lint or cotton wool and a bandage. Where excessive hæmorrhage occurs after operations for strabismus a large pad of lint should be placed on the closed lids, and firm pressure by means of a bandage kept up for a few hours after the operation. Hæmorrhage from fracture of the orbital walls is only of secondary importance to the injury caused, and may be left to itself.

Vascular protrusion.

Vascular protrusion of the eyeball.

This is the name applied, and very justly, by Mr. Thomas Nunneley ('Medico-Chir. Trans.,' vol. xlviii) to a set of cases formerly considered to belong to the class of "aneurism by anastomosis," but which Mr. Nunneley shows differ in many essentials from the latter affection, both in their clinical aspect and history. He has also had opportunities of verifying his diagnosis by post-mortem examination, and in no case has he met with an instance of the above-mentioned affection. Mr. Nunneley has reported in all seven cases, and mentions some ten or twelve others described by various writers. The cases reported are chiefly either instances of traumatic aneurism, or aneurism arising spontaneously from rupture of a diseased artery in an elderly person, but in one case a cancerous growth was found involving the orbit and other parts.

Symptoms.

The symptoms complained of by the patient are noise in the head and feeling of tension, singing in the ears, pain in the orbit and eyeball, all of which are aggravated by stooping or exertion, but are usually most annoying at night. These symptoms are accompanied by more or less protrusion and impaired mobility of the eyeball, dimness of vision, much congestion, principally venous, of the eyelids and conjunctiva, and chemosis; pulsation (which may be controlled by pressure on the carotid of the same side) detected in any part of the orbit, and communicated to the eyeball, and often an audible bruit heard on auscultation of the brow or other parts immediately adjoining the orbit.

In most cases these symptoms have come on at a varying time, after some injury to the head, or have occurred spontaneously and suddenly.

Morbid changes.

The morbid changes met with in the three cases examined after death by Mr. Nunneley were in one (in which the disease commenced spontaneously, and the patient died sixteen days after ligature of the carotid) a dilatation of the carotid at the point of giving off the ophthalmic branch, the dilatation being filled with and surrounded by coagulum; the ophthalmic artery itself was somewhat dilated, its coats thickened, and atheromatous in parts; two of its branches were much dilated and filled with coagulum. In another case, also of spontaneous origin, a circumscribed aneurism of the ophthalmic, artery close to its origin, was discovered.

The third case was found to be one of cancerous disease within the orbit, associated with cancerous tumours in other parts of the body.

Cause of vascular protrusion of eyeball.

In the majority of cases of "vascular protrusion" of the eyeball there is probably no disease within the orbit, but its seat is commonly intracranial; the protrusion is dependent on obstruction to the return of venous blood, and is analogous to the swelling and congestion seen in the limbs when the main artery is affected by aneurism.

It is easy to understand how, in a small and firmly bounded space like the cavernous sinus, a very insignificant dilatation of the commencement of the ophthalmic artery, or of the carotid itself at any point within the sinus, or a small hæmorrhage from either, may prove a most serious impediment to the return of venous blood, and, indeed, much more so than the same amount of disease would be capable of if situated in the cavity of the orbit itself.

Case of traumatic aneurism.

Nævus, as is well known, is not unfrequently met with in the orbit, but is, usually, easily enough diagnosed. (*See* p. 371.)

A case of traumatic aneurism of the orbit, which is, I believe, unique, came under my observation in September, 1873.

The patient, a young gentleman, was, some two months previously, opening a hamper in which were some bottles of soda water; one of these burst, and a large piece of glass was driven with considerable force into the left orbit, inflicting a wound in the upper eyelid, just external to the internal angular process of the frontal bone; the glass dropped out; sharp arterial hæmorrhage occurred, which was stopped by pressure; much swelling and ecchymosis of the lids followed. The wound healed, the swelling and ecchymosis disappeared, and all appeared to be going on well, but shortly before being seen by me the eyeball seemed to be somewhat protruded, and considerable congestion of the eyelids and conjunctiva was noticed. When first seen there was much venous congestion of the eyelids and conjunctiva (no chemosis), marked protrusion of the eyeball in a direction somewhat outwards; a small pulsating tumour could be distinctly felt near the inner angle of the orbit; a marked thrill was communicated to the eyeball, which could be felt on placing the hand upon the closed lids; a buzzing in the head was complained of, especially on stooping; there was a small linear cicatrix over the pulsating tumour, marking the seat of the original injury.

Ophthalmoscopic examination showed an extremely dilated and tortuous condition of the retinal veins, but no pulsation was detected; there was no impairment of vision.

Effect of pressure on carotid.

Pressure on the left carotid at once stopped the pulsation, and caused considerable decrease of the venous congestion.

Aneurismal varix was diagnosed. Perfect rest and pressure applied directly to the part were tried for some months without benefit. It was at length determined by the patient's medical attendant to perform an operation; accordingly, an incision was made over the tumour, and several fair-sized vessels which appeared to communicate with it were tied; the wound healed kindly.

Cure by operation.

I saw the patient again at the beginning of the summer of 1874. The congestion had disappeared, the pulsation ceased, and the eyeball had returned to its natural position, the only sign of the disease remaining being a small linear cicatrix in the upper eyelid and a slight thickening near the inner angle of the orbit in the position previously occupied by the pulsating tumour.

Treatment.

TREATMENT.—Rest, low diet, with depressing remedies, as cold applied locally, and the administration of digitalis or antimony, must always have a fair trial. Pressure applied locally, by means of a pad and bandage, should also be employed if it can be borne.

Digital pressure.

These means failing, recourse must be had to digital pressure of the carotid, kept up for some hours, the patient being under the influence of an anæsthetic the while, as pressure in the neck gives rise to intolerable pain, such that the most resolute can only bear it for a few minutes at a time.

Ligature of common carotid.

As a last resource, a ligature must be applied to the common carotid on the same side as the disease.

The operation was performed in all but one of Mr. Nunneley's cases with the best results.

Should a case similar to that reported in this article occur, the operation which proved so successful in it may be performed.

Exophthalmic Goitre (Basedow's Disease).

Exophthalmic goitre.

This disease is characterised by protrusion of the eyeball, impairment of the movements of the lids, and diminished sensibility of the cornea and conjunctiva, accompanied by disturbance of the heart's action and systolic murmurs in the heart and great blood-vessels of the neck together with dyspnœa and enlargement of the thyroid body.

TREATMENT.—Should the protrusion of the eyeballs be very extreme, ulceration and perforation of the cornea may occur; this may be guarded against by protecting the cornea with a small pad and light bandage applied over the closed lids, or the palpebral aperture may require to be closed by operation. General medical treatment should also be employed; for this the reader is referred to works on general medicine.

Tumours of the Orbit, Orbit and Eyeball, and Eyeball alone.

Tumours, &c.

Tumours affecting the orbit alone are—exostoses, nævi, cysts, nodes, sarcomatous and cancerous growths. Those affecting both orbit and eyeball are usually cancerous, and may commence primarily either in the eyeball or some of the other structures within the orbit. Those affecting the eyeball alone are also for the most part cancerous, but sarcomatous and cystic growths may occasionally be met with.

Tumours of the Orbit alone.

Exostoses.

EXOSTOSES.—These are of two kinds, either hard, ivory-like masses, consisting of compact bony tissue; or soft spongy growths, of an open cancellated structure.

Bony tumours are generally met with as hard, more or less circumscribed outgrowths of varying size, growing either from the bone itself or from the periosteum. They affect the orbit alone, or may project into neighbouring cavities, a fact which should be borne in mind when attempting their removal.

Treatment.

TREATMENT.—Should exostosis of the orbit give rise to inconvenience, it may be removed by operation. An incision should be made, parallel with the margin of the orbit, over the most prominent part of the growth, which, having been thoroughly exposed, should be removed in any way which may appear the most effectual, the greatest care being taken to guard the eyeball from injury, and the continuity of the lachrymal canaliculi and position of the tear puncta being, if possible, preserved. In the removal of the hard ivory exostosis the greatest difficulty will be experienced, some hours patient work with chisel and mallet being occasionally required. The Surgeon who undertakes the removal of such a growth should be aware of the extreme difficulty to be surmounted, and arm himself with a corresponding amount of patience and perseverance before commencing the operation. The soft, spongy growths are much more easily removed; the tumour, having been thoroughly exposed, can usually be broken off with strong forceps. Should the growth be on the inner side of the orbit, and much force be used in its removal, the cavity of the nose may be opened and the operator might be rather alarmed at seeing large quantities of air blown out with the blood. This accident, however, need occasion no uneasiness, as it makes no difference to the progress of the case; nevertheless, care should always be taken not to fracture the orbital walls; should the fracture take place in the roof, instead of the inner wall, the consequences would be most disastrous, as the cavity of the cranium would be opened.

Ivory exostosis.

Spongy exostosis.

Fracture of orbital wall during removal.

Nævus.

Nævus is not uncommonly met with in or about the orbit, situated generally near its margin, or in the eyelids, but sometimes growing deeply in the orbital cavity. It presents much the same characters as nævi in other situations, being soft to the touch, of a bluish colour, and becoming harder and more tense during crying or straining

Treatment.

TREATMENT.—Subcutaneous ligature is most applicable to some cases, but care should be taken to prevent as much as possible subsequent cicatrization, in consequence of the deformity it may produce in or about the eyelids. Other cases may be treated by setting up adhesive inflammation within the growth, by the use of the galvanic cautery, or by passing a number of small setons soaked in perchloride of iron through its substance. The setons should be left in until they have set up a slight amount of suppuration. Injection of the growth with perchloride of iron, solution of tannin, or chloride of zinc, may also be tried, but the greatest caution is necessary, as the operation has occasionally been followed by the sudden death of the patient.

Cysts.

Cysts.—Various kinds of cysts may be met with in and about the orbit, the most common being the congenital sebaceous cyst (*see* Operations on the Eyelids). Single cysts, probably the remains of hæmorrhages, and cysts connected with the lachrymal gland may also be met with.

Nodes.

Nodes.—Periosteal nodes are not unfrequently met with in and about the orbit; they occur as hard and sometimes painful tumours, usually situated somewhere about the orbital margin, but sometimes deep in its cavity. The existence of a node deep in the orbit should always be suspected in cases of paralysis of any of the ocular muscles, displacement of the eyeball, &c., if these symptoms be associated with nodes on the forehead or margin of the orbit and other symptoms of syphilis. Nodes gradually disappear under anti-syphilitic treatment.

SARCOMATOUS OR CANCEROUS GROWTH may be met with; they should be removed by operation.

Tumours of Orbit and Eyeball.

Tumours of orbit and eyeball

The tumours affecting the orbit and eyeball are cancerous growths which have generally commenced within the eyeball and afterwards perforated the tunics and implicated the tissues of the orbit. They are generally of that variety of medullary cancer known as melanotic.

Melanotic cancer.

The appearance of the tumour varies according to the stage of growth at which it has arrived. In an advanced case a large fungoid mass of a dirty greyish or brownish colour, having a foul surface covered in parts with dark scabs, in others discharging thin unhealthy matter occasionally mixed with blood, will be seen protruding between the swollen and distended lids. On closer examination the eyeball (as such) will be found nearly destroyed, portions of the sclerotic alone remaining in their proper position. The movements of the globe are much impaired, or altogether wanting, the growth having implicated the whole of the tissues of the orbit in one cancerous mass. It is curious how the growth as it advances beyond the limits of the eyeball loses its melanotic character and takes on those of ordinary medullary cancer.

Constitutional disturbance.

The constitutional disturbance in these cases is often severe, especially when the disease is far advanced.

Treatment.

TREATMENT.—The treatment of these growths depends much on the extent to which the tissues of the orbit are implicated and the state of the patient's health.

If the tumour be fairly circumscribed, so that there appears to be a reasonable hope of removing the whole, and the patient is in such a state of health as to preclude the likelihood of cancerous deposits in other parts, extirpation of the eyeball and other diseased tissue should be performed, any portions of growth that may be left being afterwards discharged by some escharotic. But should the orbit be so filled by cancerous deposit that there appears to be little hope of removing the whole growth, more especially if the patient is in a cachectic condition, no operation should be thought of, and the Surgeon must content himself with palliative treatment, as opiates to relieve pain, and attention to the general health.

Tumours of the eyeball.

Tumours of the Eyeball.

(1) Glioma.
(2) Melanosis.
(3) Scirrhus.

Glioma is most commonly met with in children, but occasionally in older persons.

Melanosis is usually met with in persons of from fifty to sixty years old, and occasionally in early adult age.

Scirrhus has been met with in persons past the middle period of life, but its occurrence is rare.

Glioma.

Glioma commences in the retina; it presents the following appearance:—Should the patient be a child, it will generally be healthy looking and present no signs of cachexia; attention has been drawn to the eye from a peculiar glistening appearance of the pupil (cat's eye). On examination the Surgeon will notice the peculiar reflection through the pupil, which is generally somewhat dilated but movable in the earlier stages. Examination, both by means of the ophthalmoscope and by lateral illumination, will show a whitish growth projecting into the vitreous chamber, either as a single prominence or in nodules; the growth gradually increases, its surface becomes covered with blood-vessels, the retina is displaced, and sight is soon entirely lost.

Progress of disease.

As the disease progresses the tension of the globe increases, the pupil becomes widely dilated and fixed, the iris pushed forwards and nearly in contact with the cornea, and the lens becomes opaque, preventing a view of the interior of the eye; the whole globe now gradually enlarges, frequent inflammatory attacks occur, the sclerotic becomes thinned, and at last, if the growth is allowed to remain, a slough forms near the centre of the cornea, which ruptures, and a fungoid bleeding mass protrudes.

Rupture of the cornea.

The increase of the growth now becomes much more rapid, and it may grow to a considerable size in a short time.

As soon as the growth becomes exposed to the air it commences to discharge thin sanious pus and blood, and becomes more or less coated with a dirty yellow scab. The eyelids become inflamed and swollen, sharp attacks of hæmorrhage may take place, the general health suffers, and the patient dies from exhaustion or from secondary deposits in internal organs.

Glioma in its earlier stages is likely to be confounded with scrofulous deposit within the eyeball, but it is not likely to be thus mistaken after the eyeball has become perforated.

Treatment.

Treatment.—The only treatment of glioma is extirpation of the globe, and this should be done as soon as the nature of the disease has been made out; but however early the operation may be performed, the disease is almost certain to return, either in the optic nerve, brain, or some other part.

Melanosis.

Melanosis, or black cancer, affects persons of advanced age; it is a variety of soft cancer, characterised by the development of black pigment-cells; it may grow either from the interior or exterior of the eyeball, but is generally connected with the choroid. It is said not to be so liable to recur as glioma.

Treatment.

Treatment.—Early extirpation.

Scirrhus, as above stated, is rarely met with.

Strumous deposit.

Strumous Deposit.—The appearance of this deposit within the eyeball closely resembles that met with in the early stages of glioma. The patients are usually children. There is the peculiar glistening appearance of the pupil noticed in glioma, and blood-vessels are seen upon the surface of the growth; the retina is more or less displaced by fluid between it and the choroid, and floats in the vitreous chamber. The growth goes on increasing, the pupil becomes dilated, its mobility is destroyed; the lens becomes opaque, the sclerotic thinned, the whole eyeball somewhat enlarged, and suppuration may occur; supposing the disease to have gone on up to this point, there is nothing by which it can be distinguished from glioma.

Diagnosis.

Now, however, the difference becomes manifest; the growth, instead of increasing, destroying the cornea, and projecting from the eyeball, commences to shrink, and with it the eyeball, which becomes soft, and is at length reduced to a small irregular mass. The growth of strumous deposit may become arrested at any time, and the shrinking of the eyeball commence; in this, again, it differs from glioma.

Treatment.

TREATMENT.—Should there be much pain, the eyeball must be removed, otherwise tonics and good generous diet will suffice.

Ophthalmitis.

Inflammation and Suppuration of the Eyeball (Ophthalmitis)

Is usually the result of injuries, especially of those complicated by the lodgment of a foreign body within the globe; it unfortunately not unfrequently follows operations for cataract, and may occasionally be met with during erysipelas, pyæmia, scarlet fever, &c., and sometimes in women after confinement, especially if the powers are lowered by over-lactation. The disease may begin in any of the structures of the eyeball. Should it commence in the cornea and iris, the former will become cloudy, and soon abscesses will form in its substance, the iris likewise becoming discoloured and covered with pus. The suppuration may stop short here, the cornea and iris being alone destroyed, and the eyeball left with some perception of light (*see* Suppuration of Cornea and Iris). Should the disease, however, commence in the deeper structures of the eyeball, rapid impairment of vision will take place, all perception of light being lost in perhaps a few hours.

If the pupil be clear, pus may be seen behind it, but in most cases all appears dark; the movements of the eyeball will be much impaired, and the lids and conjunctiva considerably swollen. As the disease advances the eyeball becomes enlarged and its tension increased, and if left to itself will rupture and discharge its contents, much to the patient's relief.

Rupture of globe.

The globe afterwards shrinks to a small button-like stump. Pain may be very severe in many cases, but occasionally is altogether wanting. Suppuration of the eyeball rarely sets up sympathetic changes in the fellow eye.

Treatment.

TREATMENT.—This depends upon the cause of the disease, and whether one or both eyes are affected. Should the inflammation depend upon the lodgment of a foreign body, this should be removed without any reference to its position or the state of vision; if the eye have still good perception of light it will certainly be destroyed, and whatever difficulties the Surgeon may encounter he cannot possibly make matters worse, and should not hesitate an instant, or he will lose his chance of preserving any sight that may be left. Any foreign body having been removed, the Surgeon's next care should be to relieve pain, and, if possible, check the progress of the inflammation.

Removal of foreign body.

These indications are best carried out by the application of leeches (if the patient be strong, and can bear bloodletting), by opium internally, and by the constant use of sedative fomentations; the best being the Fotus Belladonna (made by dissolving a drachm of extract of belladonna in a pint of warm water) mixed with an equal quantity of Fotus Papaveris (made by boiling an ounce of poppy-heads in a pint of water); a piece of rag or lint soaked in this mixture as hot as it can be borne should be kept constantly applied to the affected eye.

Fomentations.

Poultices may also be employed. Most patients will require the administration of a fair amount of stimulant, good living, with iron and quinine.

When suppuration has been fairly established, and all perception of light lost, the eyeball must be treated as an ordinary abscess and the pus let out by incision.

Incision.

AFFECTIONS OF THE EAR.

CHAPTER IX.*

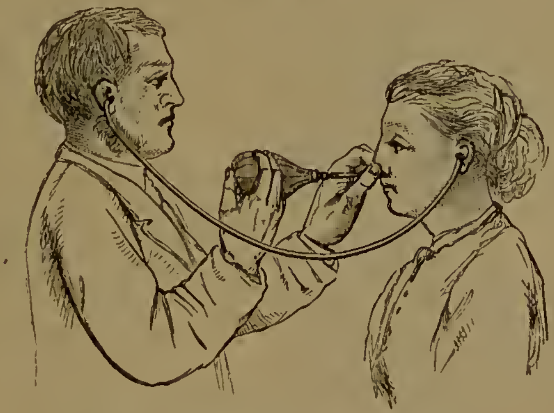
AFFECTIONS OF THE EXTERNAL EAR.

Malformations.

Malformations.—The malformations of the external ear which are met with are very varied, extending from cases in which there occurs an entire want of the auricle to those in which the possession of a double set is seen. In cases where the hearing is not affected by the malformation the surgeon may be consulted as to the propriety of an operation with a cosmetic view. He must in these regulate his opinion by the usual surgical rules, having regard to any possible interference with the acuteness of hearing which an operation might entail. The most common malformation is a congenital, either partial or entire, want of the auricle, with a failure of the meatus auditorius externus. But the auricle may be absent from injuries, and the meatus closed from otitis, lupus, &c. Such defects do not necessarily occasion an absence of the hearing power, and cases are on record in which patients with this defect could hear sufficiently well to hold conversations with those to whose voices they were accustomed. Before deciding to operate in such congenital cases it is advisable to keep the child under observation for some time for the purpose of noting if any signs of hearing are developed. Should it be determined to operate, the point of operation may now and again be fixed by passing a current of air through the Eustachian tube, and noting the point at which the impingement of air at the end of the cul-de-sac is heard best. This is accomplished by using what is generally called "Politzer's method," (Fig. 96) which consists in passing the soft nozzle of a caoutchouc bag filled with air into one or other nostril of the patient, and, while he swallows a mouthful of water, compressing

Treatment.

FIG. 96.



Politzer's method of examining middle ear.

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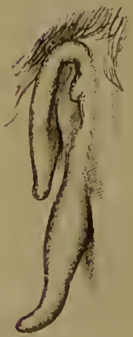
* In this chapter I have had the able assistance of my colleague Dr. Laidlaw Purves.

the nostrils with the fingers of the left hand so as to prevent the exit of air through them. At the same moment the right hand forcibly expels the air from the bag in such a way that, finding no passage open except the Eustachian tubes, it rushes up them, passes into the tympanic cavity, and pushes out the membrana tympani. It is this sudden rush of air against the external wall of the cavity which the surgeon listens for by means of a tube of india rubber, passing from the meatus of the patient to that of the surgeon. In cases of absence of the meatus a stethoscope may be used, by which the surgeon determines at which point the air impinges most forcibly, and at this point he makes his opening. If hard and bony at this spot, the trephine will be necessary if soft, the knife will suffice, making a crucial opening and keeping the opening patent by means of tents or other foreign bodies. In congenital cases the opening ought to be made very carefully, watching for the membrana tympani; but should there be no membrane found on cutting down to the usual position of such it is advisable to allow the artificial opening to close again. If the deafness before operating is very great it is probably better to discountenance any operation, as the results of interference with the congenital malformations of the ear have generally been by no means satisfactory.

Cutaneous affections. **Cutaneous affections of the external ear.**—Hypertrophy from chronic inflammation, eczema (acute and chronic), herpes, impetigo, pemphigus, erysipelas, affect the auricle, and have much the same appearances, follow the same courses, and are amenable to the same treatment as Treatment. in other parts of the body. Particular attention ought to be paid to any skin affection which may be present in the neighbourhood of the auricle, especially in the hair, careful note being paid to the sort of pomade or other application the patient uses for cosmetic purposes. The meatus auditorius externus ought to be cleared once daily by a lukewarm water injection of any collection of epidermis or cerumen which is apt to be of a greater quantity than normal during the progress of the skin affection.

Injuries. **Injuries to the external ear.**—Injuries to the external ear are by no means rare, but, happily, if confined to the auricle, they affect the hearing of the sufferer but slightly. Under the usual treatment they generally do well, care being had to make as perfect an adjustment of the parts as possible. In 1866 I treated a girl of twelve years of age for the effects of an ulceration of the external ear some years previously. The condition of the ear is indicated in the accompanying engraving (Fig. 97). By paring the edges of the pendulous portions of the auricle, and the skin covering over the parts behind, a good-looking entire ear was made with great addition to her comfort.

Fig. 97.



Drawing 22439½.

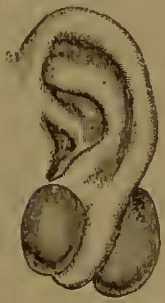
Tumours of auricle. The tumours of which the auricle may be the seat are the othæmatomatous, gouty, fibro-plastic, fibro-cartilaginous, sebaceous, erectile, epitheliomatous, and sarcomatous. The fibro-plastic or cheloid has been already alluded to as occurring in the lobulus of the ear after the operation of puncture. I have seen many such, the largest having been the size of a walnut (Fig. 98). They generally do well after excision, but if not thoroughly removed will grow again. The othæmatomatous requires especial mention, but the others are to be recognised and treated as in other parts of the body.

Report by Dr. Goodhart on Cheloid Tumours of the Ear.

Cheloid tumours.

The small tumours or thickenings of the skin, which usually go by the name of cheloid (Alibert), are of inflammatory nature, with more or less tendency to become fibrous. These drawings, made from a section of one of these growths in the lobule of an ear which had been pierced for an earring, show the microscopical characteristics. Its macroscopical appearance was that of a fibrous tumour. It will be seen that, in addition to newly formed fibrous tissue, there is also a great deal of nuclear germination going on.

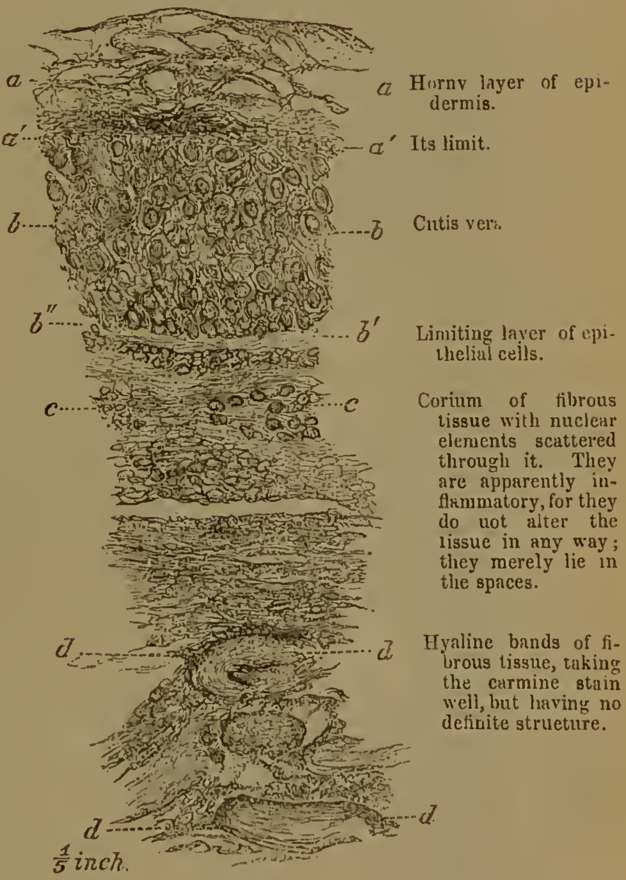
FIG. 98.



Cheloid tumour of ear.

Fig. 98A gives the microscopical appearances of one of those cheloid tumours from the pencil of Dr. Goodhart.

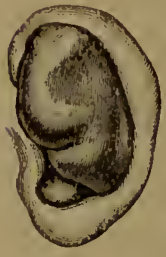
FIG. 98A.


a
a Horny layer of epidermis.
a′
a′ Its limit.
b
b Cutis vera.
b″
b′ Limiting layer of epithelial cells.
c
c Corium of fibrous tissue with nuclear elements scattered through it. They are apparently inflammatory, for they do not alter the tissue in any way; they merely lie in the spaces.
d
d Hyaline bands of fibrous tissue, taking the carmine stain well, but having no definite structure.
d
d
1/5 inch.

Hæmatoma.

Idiopathic hæmatoma auris, or vascular tumour of the ear, consists, according to the latest trustworthy authorities, of a degenerative morbid process induced by general disturbances of nutrition. The cartilage of the auricle is its seat, but the pathological appearances differ, as some have found the perichondrium separated from the cartilage, while others have found "pieces of the cartilage attached to the perichondrium." In other cases the cartilage has been found thicker but no harder than natural, the thickened part presenting no appearance of a cyst, but under the microscope showing hypertrophied cartilage-cells and intercellular matter. This idiopathic hæmatoma commences by a flushing of the auricle, which becomes hot and painful. In a few hours an effusion of blood takes place, which, generally commencing in the concha, gradually spreads over the auricle, feeling firm to the touch, but allowing of fluctuation being detected if looked for with care. It is believed to be peculiar to patients suffering from different forms of insanity, general paralysis having the largest share, melancholia, acute and chronic mania and dementia, following in the order named. Dr. Hun thinks that the affection obtains such an exclusive position amongst the insane that he holds that any one suffering from hæmatoma auris, although sane at the time of observation, ought to be suspected of insanity.

FIG. 99.



Hæmatoma auris.

That the affection occurs in persons who have no hereditary history and show no symptoms of insanity is undoubted, but whether the pathological changes at the seat of the tumour are the same in those cases or differ in the other cases in which there is a history of traumatic injury is yet undetermined, though I am inclined to believe from the cases which have come under my own notice that those resulting from injury do not arise from the same pathological changes.

Treatment of hæmatoma.

The modes of treatment recommended by different authorities vary. Gruber recommends evacuation of the fluid and coagula and the after-use of a compress bandage, while Wendt relates a case where vascular tumour recurred twice after incision, but passed off under lead-water applications and compression. I have tried the different methods proposed, once passing a seton through the tumour and keeping up a slight discharge from it, and find them get well under all the different methods. Since the application of astringent lotions and a compress is less alarming to the patient, and seems as effectual, I am inclined to follow it in future cases, keeping up the compression by a modified letter clip applied to the ear, padding the arms of the clip so as to prevent injury to the skin of the auricle.

Affections of meatus.
Ear speculum.

Affections of the external meatus.—To examine the external meatus it is usually necessary to employ a speculum for the purpose of straightening and widening the canal, and so allowing of the passage of rays from a natural or artificial light. The specula are formed of silver or caoutchouc and are of various forms. The silver speculum of Wilde, with a round aperture at the narrow end, will be found as convenient as any, it being necessary to have three or four different sizes. If available, sunlight, either direct or reflected from a white cloud, is, I think the best mode of illumination, as it gives the different tints of the meatus and tympanic membrane more truly than any artificial light. Seating the patient near a window, with the ear to be examined away from the window, you receive the rays on a mirror either held in the hand or placed on the forehead, and reflect them into the meatus by inclining the mirror to the required angle. If you use the rays direct from the sun itself it is necessary that a plane mirror should be used, the usual concave mirror soon causing such an amount of heat to be felt at the spot on which the reflected rays are thrown that the patient cannot endure a long examination. Should sufficient daylight not be obtainable, an argand burner, with or without a bull's-eye lantern placed over it, will act as a good substitute. Having arranged your flood of light so that it falls on the auricle and external meatus, you take the superior and posterior part of the auricle between the middle and index fingers of the left hand, and, pulling the auricle backwards and upwards, you widen more fully the lumen of the meatus, into which you introduce by the right hand the small round aperture of the speculum. Passing it gently in by a slightly rotating motion, you reach a spot where, there being no foreign body to occlude the view, if the meatus is of a normal width the tympanic membrane will be exposed to view. On accomplishing this, the external edge of the speculum is passed to the care of the thumb and index fingers of the left hand, which move it in different directions so as to throw rays on the different portions of the canal and the tympanic membrane, while the right hand is left free to use the mirror, or, placing the mirror on the forehead, to use any instruments which may be necessary.

Cerumen.

The most frequent change in the external meatus which comes before the Surgeon on thus looking into the canal is an accumulation of cerumen, known by its position, form, colour, and light reflection. It occurs on account of some hyperæmia of the ear, of which a very common cause is the irritation arising from scratching the meatus with pencils, pins, &c.; but anything which causes an increased flow of blood to the lining membrane of the meatus will cause a greater accumulation of cerumen than normal. It also occurs in those much exposed to the sun and dust, in those who perspire freely, and in the old, in whom the cerumen is denser and stiffer than in the young.

Symptoms.

The subjective symptoms caused by such accumulations are pain, vertigo, confusion of ideas, tinnitus aurium, and deafness, the latter symptom being often characterised by its sudden entrance and departure.

Prognosis.

The prognosis is not so favorable as is generally supposed. If a vibrating tuning-fork placed on one of the incisors or on the middle line of the vertex is not heard better, or so well, in the affected ear as in the non-affected, you may expect some complication, and the mere removal of the cerumen will not probably be followed by much beneficial result to the deafness. Toynbee gives, as the results of his removal of accumulations of cerumen from the meatus causing deafness, a table of 165 cases, of which 60 were cured, 43 were improved, and the remaining 62 were "either but slightly or not at all improved." Mr. Hinton gives one in six as his proportions of recovery in the same. It will thus be seen that in a large proportion of cases of accumulation of cerumen in the external auditory meatus there is a complication present which does not give way on the removal of the cerumen, and which clouds the prognosis considerably.

Treatment.

If you can easily lay hold of the accumulation by means of the forceps without risk of pushing it against the membrane, and without causing pain, it is well to remove it in that way, especially if you are removing it for the purpose of obtaining a view of the parts behind which you wish to examine on account of some affection present, as, should there be some abnormality of the parts behind, the passage of a strong current of water might prejudice them. But should it not be practicable to remove the accumulation by the forceps without causing irritation, the syringe must be used in the manner described in treating of foreign bodies in the meatus.

A lessening of the secretion is sometimes seen in acute affections of the middle ear and in nervous deafness, but, before making your diagnosis in such, inquiry of the patient as to what he has done to the ear before coming to you is useful in eliciting a good reason for the condition found. The use of some slight emollient and attention to the primary cause, if any such is detected, comprises the treatment.

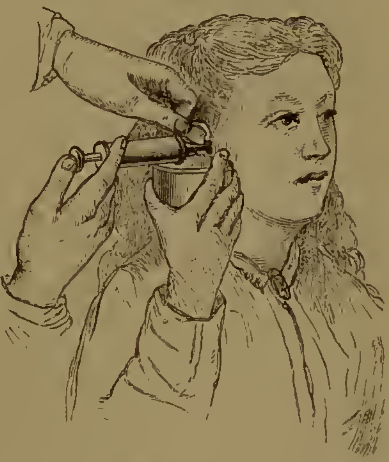
Foreign bodies.

Foreign bodies.

Treatment.

In no department of surgery is the aphorism that "blind zeal only hurts" more necessary to be remembered than in that relating to foreign bodies in the ear. The form of the canal is so peculiar, being that of a spiral turning anteriorly inwards and downwards, and having expansions at either extremity, and the forms of the foreign bodies which enter or are placed in the meatus are so varied, that the efforts to remove them by any other means than a current of water must be used only where the practitioner is guided by an accurate knowledge of the anatomy of the external meatus, if damage to the delicate structures which limit the inner end of the meatus is to be avoided. So common are forcible attempts to extract by those unaccustomed to meet such cases, that it is exceptional that a case is seen by the Surgeon before such efforts have been made as have caused a certain amount of inflammation of the canal and its consequent lessening in caliber. In such, where the caliber has been rendered too narrow to admit of the passage of the foreign body without considerable force, the first indication is to allay the inflammation by rest, leeches, and fomentations. The exudation having been absorbed, and the canal having nearly or wholly resumed its normal size, the Surgeon ought to determine whether there is a foreign body present, and, if possible, its size, form, and position, for cases continually occur in which a patient suffering from chronic disease of the middle ear has the feeling of a foreign body being present, while others are either the subjects of delusion from other causes, or are attempting to delude you. This information is obtained by means of the usual mirror, speculum, and probe, by the last of which you can determine if the body is hard or soft or moves easily. If the last is the case you may, by inclining the head to the side of the ear affected, shake it out, or by laying the one hand on the ear a sharp percussion on the hand so placed may remove it. But the persevering use of an injection of lukewarm water from a four- or five-ounce syringe, the point of the nozzle of which has a caliber of from one to two millimètres, is the method which ought to be used above all others, which carries with it the least danger, and is by far the most successful. A bowl being held by the patient so that the rim is pressed against the skin close under the lobule of the ear, the Surgeon draws the auricle upwards and backwards so as to straighten the external meatus, and the nozzle being passed slightly within the external opening and pressed against the upper wall, a moderately forcible current is made to pass along the upper wall, sweep across the membrana tympani, and by it is directed outwards, in which latter course it meets with the foreign body, and, carrying it with it, forces it along the lower wall of the canal and out at the external opening. It may be necessary to change the position of the patient's head so as to give the stream a different direction, according to the position of the foreign body in the canal, the endeavour being always to pass the inward current beyond the body, which ought to be influenced only by the outward rush. Should the body be impacted it may be necessary to loosen it by the probe before you can remove it by the syringe, but the first injections generally suffice to do this. This failing, which is extremely rare, and the body being soft, you may pass a hook into it from the side and so extract it; or should it be too large for this you may, having fixed it with the hook so as to prevent it passing further in by your manipulations, pull pieces out of it by means of small kneed forceps and so reduce its bulk sufficiently to extract by the hook. When the body is hard and so formed that the current cannot have much influence upon it, and a hold by forceps or hook cannot be obtained, Lowenberg's method of bringing the point of a camel's-hair pencil armed with joiners' glue or other glutinous material into contact with the body, allowing the viscous substance to harden and thus binding the pencil and the foreign body together and so extracting them, is sometimes useful. Many other instruments have been proposed to remove foreign bodies, most of which are not worthy of a place in the Surgeon's armamentarium, but mention must be made of Wilde's wire snare, which may be found very useful and has the advantage of being very safe, and Mr. Durham's ear forceps, which allows of the passage of the instrument through a narrow speculum—a very great desideratum.

FIG. 100.



Syringing ear.

It may happen that none of the above-mentioned means will enable you to extract the body, and yet the symptoms of pressure on the nervous structures—giddiness, confusion, delirium, &c.—are so urgent that removal is imperative. In such you may be compelled to place the patient under chloroform, enter the meatus by loosening the auricle from its superior attachments, or through the mastoid process, and so reach the offending body and extract. But resort to such serious measures will only be called for by the most pressing symptoms, and then probably in cases where violent unsuccessful efforts to extract have been made, as the mere presence of a foreign body in the external meatus rarely causes much pain or annoyance.

Before attempting to remove certain bodies it is necessary to place them in a condition favorable to their removal or to allay the unbearable irritation caused by some of them. For example, a ball of cerumen may be so hard that no instrument will pierce it sufficiently to give the Surgeon sufficient purchase upon it to extract it, or it may be too large to pass the isthmus of the external meatus without he use of undue force. In such you are compelled to soften it by repeated soakings in hot water or a solution of glycerine, or some alkaline solution, before endeavouring to break it up. Again, when some small animal has passed into the ear and its movements are causing great annoyance by irritating the excessively sensitive tympanic membrane, it is necessary to introduce tobacco smoke or water, or a little spirit and water, or oil, to kill it, and at once allay the irritation before attempts at removal are undertaken.

Maggots are sometimes found in the external meatus and tympanic cavity, especially in cases of otorrhœa, and are generally difficult to remove. Should the membrane not be perforated the syringe will suffice, but, as in the cases in which they are mostly found the membrane is perforated, the forceps is found more effectual. To allay the pain generally occasioned by their presence the injection of a lukewarm solution of a grain of acetate of lead and a grain of acetate of morphia in an ounce of water, of which ten minims may be injected three or four times daily, will be found of service. Various kinds of aspergilli are met with, especially in climates warmer than that of England; but even in England they are more common than is generally believed, judging from the cases reported in the medical journals as rarities and worthy of notice. The appearance on examining the meatus with the speculum is as if fine meal had been blown into the ear, or as if "coal dust had been blown on to white sand." The true diagnosis can be made certain by the microscope only. The parasiticides proposed are many, but warm water often used or a mixture of spirit and water will suffice in all cases.

Should it be found after the removal of any foreign body that the tympanic membrane has changed its position, and does not of itself recover its normal situation, the air-bag or catheter or the vacuum speculum may be of benefit in assisting you to replace it.

A piece of wadding should be lightly inserted in the meatus after the removal of the foreign body, and kept there for some hours, so as to protect the irritated parts from cold, strong noises, &c.

It ought to be remembered that foreign bodies in the ear may cause many reflex actions, such as tickling in the throat, giddiness, pain and heaviness in the head, vomiting, cough and expectoration, sneezing, anæsthesia of side, epilepsy, &c.

Furuncles.

Furuncles of the external meatus originate generally in one of the hair-follicles or in one of the ceruminous glands. They occur mostly as the symptom of some constitutional affection, in which case they are associated with boils on other parts, or of some deeper local chronic inflammatory lesion, and are considered in such as a favorable sign. The long-continued use of astringent lotions, especially of alum solutions, seems to place the meatus in a condition favorable to their formation, if it be not the actual cause in some cases. The symptoms they occasion are great throbbing and pain, consequent on the unyielding condition of the skin and connective tissue of the external meatus to the pressure from the accumulating pus, fever (especially during the evening), sometimes tinnitus, a feeling of tension in the ear, and more or less deafness, according to the position and extent of the inflammation. They occur at all ages and in all constitutions, but middle age obtains by far the majority of cases. The prognosis is favorable, though you may be unable to check the formation of new crops, which go on for months, even in the most robust people.

Treatment.

The treatment is conducted either with a view to arrest the development of the abscess, or the formation being complete to give the pus free exit. The former may be brought about by painting the swelling with a strong solution of nitrate of silver (ʒss—ʒj to ℥j of water) or a solution of sulphate of zinc of the same strength. The latter is best accomplished by a small narrow knife, so narrow in the blade and handle that it does not exclude your view of the part while making a free incision through the boil. After making the incision I find it useful to apply a vacuum speculum (Siegle's—*see* article on Affections of the Membrana Tympani) to the meatus, and by suction empty the abscess as much as possible of pus, and at the same time obtain a free flow of blood from the wound. The application of moist heat afterwards by frequently filling the ear with warm water, and laying for half an hour or so a cataplasm over the whole ear so filled, of leeches in front of the tragus if there is much pain, or of a plug of cotton which has been saturated with glycerine (Fisher), changed twice daily, for the same purpose, and the judicious use of purgatives, result in a favorable termination to the particular boil in question, but the constitutional treatment must follow to prevent, if possible, the development of others. As a local preventive, Mr. Hinton considered that the application to the meatus of red or white precipitate ointment was of service.

Narrowing of meatus.

Narrowing of the meatus in the cartilaginous portion occurs not unfrequently in the aged, on account of the tense tissue-bundles of the posterior and upper walls having become loosened and sunk forwards against the anterior wall. This narrowing seldom leads to complete closure, and therefore does not influence the hearing power to any extent, but its presence prevents the normal exit of the cerumen, and so tends to the formation of cerumen balls beyond the narrowed part of the meatus, and their results. Other narrowings, besides those which are congenital, arise from thickening of the skin after frequent attacks of inflammation of the meatus, after furuncle and other tumours, eczema, and the long use of astringent lotions or ointments. Except in the case of tumours, you may widen the canal by the use of the *Laminaria digitata* or sponge dilators sufficiently to form your diagnosis and apply remedies. Treat any affection of the tympanic cavity which may be present. Keep the canal clear of cerumen and epidermis by injections of lukewarm water or the passage of a dry camel's-hair pencil, and by the use of small ivory bougies, gradually increased in size so that the amount of pressure may be kept up, promote absorption.

Treatment.

Exostoses.

Exostoses of the meatus are found in individuals of the gouty, rheumatic, and syphilitic diatheses, though their connection with this last diathesis is not well established. They are certainly frequent in the meatus of good livers, who are likely to have their mucous membranes frequently congested. On looking into the meatus an elevation is seen, generally about the middle third, the skin over which is reddened and moist, and pressure on which by the sound causes pain.

Treatment.

The treatment is not satisfactory, unless the exostosis has a pedicle, in which case it may be broken off. In other cases, having paid attention to any affection causing congestion of the mucous membrane of the tympanic cavity, the application of iodine to the growth itself, and behind the ear, so as to keep up a slight counter-irritation for a lengthened time, and the exhibition of it internally, offer the best hopes of resolution. Should, however, the exostosis prevent the exit of pus from the parts internal to it, the formation of a channel by a hammer and chisel or trephine, and the maintaining of it by tents, may be imperative for the purpose of keeping the parts clean and the application of medicaments to the parts beyond.

Hyperostosis. **Hyperostosis of the bony meatus** is seen after a chronic otorrhœa, and generally extends through the whole of the bony canal. It is caused by inflammation of the periosteum, which results in a well-developed bony formation. The skin along the narrowed portion of the canal is more or less congested. The treatment is that of exostosis.

Molluscous tumours. **Molluscous tumours** of the meatus consist of accumulated laminæ of epidermis, enveloped in a thick membrane. Though thus composed of comparatively innocuous material, they have the power of causing absorption of the bone lying in contact with it, passing through it by a clean cut aperture without affecting the bony sides of the canal thus caused, and so pursuing their course pass to and press on the parts beyond, causing symptoms varying according to the parts implicated. The diagnosis of this molluscous tumour from exostosis is made by pressing a probe on the skin over the tumour, and noting the hardness of the enlargement. Laying open the tumour, washing out the accumulated epidermis by the syringe, and withdrawing by the forceps the lining membrane, is the treatment recommended.

Syphilitic affections of meatus. **Syphilitic affections of the meatus** occur as fissures and ulcerations near the orifice, condylomata, and exostoses. The ulcerations exhibit the usual punched-out irregular contour and discharging surface. The treatment is the usual, general and local.

Otitis externa. **Inflammation of the external auditory meatus, or otitis externa,** is an inflammatory affection of the cutaneous tissues of that canal, involving more or less, according to the violence of the attack, the periosteum of the osseous part of the canal and the membrana tympani. Symptoms. The patient complains of a continual itching sensation, with a feeling of heat and dryness, in the canal, which compel him to pass any suitable instrument which may be at hand into the meatus for the purpose of scratching the part implicated. This irritation may pass off without forcing the patient to seek advice, or it may pass on to one of pain shooting over all the affected side of the head, increased by every motion of the head or by mastication, and accompanied by a feeling of fulness in the ear, by fever and deafness. After this congested state has lasted for two or three days that of exudation enters, at first as a bright watery discharge, which gradually assumes a mucous character, and this in its turn gives way to a yellow purulent appearance. The pain, which till now has been usually severe, subsides when the purulent discharge shows itself, or soon afterwards, and the patient feels lighter and freer of the sensation of "numbness" or "fulness" of which he before complained. A favorable termination without any treatment may now take place, though more frequently the affection becomes chronic and the patient suffers from recurrent attacks on being affected by any exciting cause.

Appearances. In examining the ear it is not always easy to arrive at a satisfactory diagnosis on account of the painful swelling of the canal, which is particularly sensitive about the middle third, and resents the introduction of a speculum. When you are able to introduce the speculum sufficiently well to see the inner part of the meatus you may find a mass of moist or macerated white epidermal lamellæ obstructing your view of the membrane, necessitating the careful use of the forceps or injection of warm water for their removal. Having removed these and obtained a view of the membrana tympani, you find in those cases in which that membrane is affected (and it is rare that you are consulted before it is so), the vessels of the membrane increased in number and size and fully injected, or, if the case has reached a further stage, the single vessels are no longer visible, and the whole has a resemblance to a red blennorrhœic conjunctiva. The natural angle formed by the skin of the external meatus and its continuation with the dermoid layer of the membrana tympani is obliterated, or nearly so, by the pressure of the exudation inside the cutaneous tissues. But the exudation may be so great and may have so narrowed the canal of the meatus that only a small part of the membrane can be seen, its appearance depending upon the part seen and the stage of the affection. The acute stage being neglected, it passes gradually into the chronic form, in which there is generally little swelling of the meatus, possibly here and there slightly macerated or pus-covered spots which bleed easily on being acted on by the speculum, or brown, badly smelling crusts standing upon half dried secretions. The amount of secretions varies from a moisture discernible at the external opening of the meatus to three or four ounces daily of a high-smelling yellow discharge, and changes by the seasons and other influences. The alarming results of the affection are dependent upon the continuance of this otorrhœa, which, if of long standing, may cause opacity or thickening of the membrane, polypi, maceration of the surrounding tissues, with ulceration of the membrane and its consequences, inflammatory and purulent processes in the dura mater and its sinuses. These latter are especially frequent in children in whom the conditions for the transmission of such processes are easy.

The diagnosis of this diffuse inflammation of the meatus from that of furuncle of the meatus is made by means of a speculum in which a small mirror placed at the end of the instrument may be revolved so as to give the observer a reflected image of the different parts of the meatus in succession, or by means of Blake's small mirrors; or should neither of these be admissible by the contraction of the meatus, by the moist appearance of the dermoid covering of the membrana tympani in furuncle, the same layer in otitis externa having the appearance of the rest of the meatus.

Causes. The causes of inflammation are the passing of any acute or chronic exanthemata to the meatus, irritation or injuries to the ear, as by the application of heat or spirits to the meatus, the prolonged use of injections, the presence of foreign bodies, the passage of cold currents of air or water, the non-drying of the ear and hair round it thoroughly after washing, the presence of fungi, and, in short, anything causing a congestion and irritation of the lining membranes of the meatus

The affection may run its course in ten or fourteen days if the purulent stage has not been reached, but that stage having supervened it lasts from five to eight weeks generally.

Prognosis. The prognosis in a usual primary case under treatment is favorable, but relapses are common. The form following an acute exanthem is very different, as should the middle-ear inflammatory process be well developed, and the membrane much affected, the chances of saving an entire membrane are lessened.

Treatment.

Wilde's incision.

The treatment is etiological. If there are foreign bodies present their removal demands your first attention, and after this the prevention of any purulent accumulation and the use of frequent injections of warm water are the chief treatment. Should the swelling be great, scarification of the meatus, or an incision and abstraction of blood by the vacuum speculum, seems to be of more use than any other means in causing a speedy subsidence of the thickened membranes, which you may also assist by keeping up a pressure on the circumference of the canal by charpie gently pressed into the meatus, being careful that the charpie is frequently renewed and the meatus cleared of discharge. What is called Wilde's incision, from its having been first brought into notice by Sir William Wilde, is a favourite means of remedy with some, and in the relief of pain, or as a means of giving exit to any exudation which may have passed towards the mastoid process, is very useful. It consists in making an incision down to the bone over the mastoid process, at a distance of from half to three quarters of an inch from the auricle, carefully avoiding, if possible, severing the posterior auricular artery. The application of leeches in front of the tragus (should the patient be too timid to allow of the abstraction of blood by incision or scarification) is advisable where the pain is severe. During the painful stage no strong astringent lotions must be used, those of a sedative nature being preferred, as morphia, in the strength of gr. j ad aq. dest. ʒss, or sulphate of atropine gr. ij to ℥j. This stage being passed, the use of the customary astringent lotions—alum, sulphate of copper, sulphate of zinc, in solutions of from one to four grains to the ounce, or nitrate of silver of from ten to twenty grains to the ounce—are, with attention to any complication of the middle-ear apparatus and to the diathesis present, sufficient to ensure a favorable course. Should the affection have assumed the chronic form, stronger solutions of the astringents mentioned ought to be employed; and the keeping up of a counter-irritation behind the mastoid by tincture of iodine, cantharides ointment, or other irritant, will be found serviceable.

Polypus.

Treatment.

Polypus.—Aural polypi generally show themselves during a chronic purulent discharge from the tympanic cavity or external meatus, and are not only caused by such a discharge, but are themselves a means of increasing it by furnishing an additional secreting surface, and, by preventing the exit of discharge, keeping the parts pressed upon by the pus in an unhealthy irritable condition. They are of different forms and appearances, being of a lively red, rich in blood, soft and easily bled by touching, or firm and solid with a glancing surface, grape-like or ragged, so small that their presence can only be determined by a careful inspection of the deeper parts, or so large that they protrude from the meatus. Their positions are as varied as their forms, as they arise from any part of the meatus or tympanic cavity or membrane, the different authorities not being agreed as to which are the most frequent sites. Happily their diagnosis and treatment are the same, the former being their capability of displacement by the sound, and the latter their removal either by caustics, astringents, the forceps, or Wilde's snare. If the polypus is sensitive, which is not usually the case, and the patient will not suffer the removal by instruments, the application of undiluted liquor plumbi, or alum, or tannin powder, regularly for a time, care being taken that each new application meets with a clean surface, will suffice; but the treatment above all others is the immediate removal by instruments as far as possible, and the application thereafter to the root of some caustic, such as acetic, nitric, or chromic acid, by means of a glass rod or a piece of wood. The instruments employed for the purpose are numerous, those which I find most useful being Wilde's snare, Durham's forceps, and Hinton's forceps. Wilde's snare is especially valuable, as by its means you are capable of reducing a polypus to a considerable extent without endangering any of the structures near it, while the others have the advantage of easier adaptation to an excrescence which is difficult of reaching. Should the polypus be very small, or so situated that you cannot use a cutting or tearing instrument, the application of a thin layer of nitrate of silver, obtained by heating a crystal of the caustic over the flame of a spirit lamp and placing a probe or piece of stout silver wire against the heated crystal, will be found useful in cauterizing it, and at the same time limiting the application to the desired spot, which is not so easy when solutions are employed. After the removal of the polypus the disease, of which the growth was only a symptom, must be attended to.

Affections of the Middle Ear.

Affections of the middle ear.

Injury to the tympanic membrane.

Injury to the membrana tympani.—Rupture of a healthy tympanic membrane is usually caused by the introduction of some sharp instrument through the external meatus, the efforts to extract some foreign body from that canal, or by a sudden concussion over the auricle, as by a blow from the hand, the unexpected explosion of artillery, or such like. The diagnosis of rupture in such is easily ascertained, but medico-legal questions sometimes arise in which it is necessary to determine whether a rupture was caused by a blow on the ear or was present before the blow was given, or whether the membrane was in such an unhealthy condition that it would be easily injured. The rupture of a healthy membrane caused by a blow is usually a long gaping tear,—the gaping depending on the action of the radiating fibres of the middle layer,—the edges of which have a coating of blood upon them. The rest of the membrane is healthy, free of thickening, opacities, cretaceous or other deposits, though possibly hyperæmic. On passing a current of air through the Eustachian you hear a continuous broad soft sound, unlike the broken hiss from the perforation of a diseased membrane, unless some time has elapsed since the rupture was made, in which case infiltration and exudation may have occurred, giving the appearances and sounds of a diseased membrane. The prognosis, unless pus has formed to some extent, and deafness to a considerable extent is present, is very favorable, and the perforation will be quickly healed. Should, however, considerable deafness and tinnitus have occurred from a blow, either with or without rupture of the membrane, the prognosis is unfavorable, as probably the stapes has been driven into the labyrinth, tearing the nerve-fibres and possibly remaining fixed there, and you must keep the patient a lengthened time under observation before giving any opinion of what the results will be.

Rupture of membrane.

Prognosis of rupture.

Inflammation of the membrana tympani, or myringitis, is probably always associated with some affection of the internal or external parts

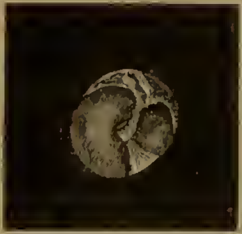
Myringitis.

contiguous to it. The diagnosis and treatment will be found in the description of inflammation of the external meatus.

Examination of a tympanic membrane.

In examining the membrana tympani the points to be noted are its colour, transparency, lustre, light cone, inclination, curvature, entirety, tension, whether adhesions are present or not, and the position of the malleus, especially of its short process. For a full description of these we must refer the reader to Politzer's 'Beleuchtungsbilder des Trommelfills im Gesunden und Kranken Zustande,' Wien, 1865, but the following short note of changes seen in the most common affections in which it is implicated may be found useful in diagnosis. In acute inflammation the membrane is smooth and glistening, and more or less red according to the amount of hyperæmia present. When the mucous layer is hypertrophied, and accordingly a greater amount of secretion present than in the normal state, the membrane is less shining than natural, and has a whitish-grey parchment look. If there is a considerable accumulation of mucus which has lain in contact with the membrane for some time, it assumes a sodden appearance as if the parchment had been steeped in fluid. The changes of inclination and curvature of the membrane depend upon closure of the Eustachian tube, adhesions to the other walls of the cavity, accumulations of pus, mucus, or tumours, internal or external to the cavity, and perforations or thinnings of the membrane, and can only be diagnosed by seeing numerous cases at an aural clinique. The fact that usually only one eye is brought to bear at a time on the membrane makes it difficult for the observer to judge of displacement, protrusions, or any changes in which the judging of distance is required, till he has accustomed himself to the use of one eye only.

Fig. 101.



Appearance of membrana tympani, showing the relation of parts to each other. (Right ear.)

Perforation of the membrana tympani.

Chronic perforation of the membrana tympani is one of the most common affections of the ear on which you will be consulted. The diagnosis of the affection is easy, either by the speculum, by asking the patient to drive a current of air by a forcible expiration through the Eustachian tubes, the nostrils and lips being held firmly together,—this method being called Valsalva's method,—by passing a current of air from Politzer's bag, as described under malformations of the external ear, or by passing the Eustachian catheter and forcing a current of air from the mouth or from an india-rubber bag through the catheter. By these three last methods you will obtain—the Eustachian tubes being open—a sound more or less of a hissing character, depending upon the rush of a column of air through a small orifice. The usual causes of the perforation of the membrane apart from those of a traumatic origin are scarlet fever, measles, tuberculosis, and any greatly debilitating affection in which the mucous membranes are affected.

Prognosis.

The prognosis is regulated greatly by the dyscrasia present, but it ought always to be remembered that a perforation may heal without leaving any discernible pathological changes, and without in the slightest recognisable degree lessening the power of hearing. The hopes for such a happy result are the greater the shorter the acute attack which has caused the perforation, while it is rare after a chronic affection accompanied by otorrhœa; but no opinion ought to be hazarded till you have carefully washed out the ear and seen the extent of the perforation and losses which have already resulted therefrom. The process of healing is known by a gradual diminution of the secretion and of the perforation, the cicatrix being formed by the dermoid and mucous layers, but of a much more delicate structure than the natural layers, and not separable into laminæ. The hopes of cicatrization are at an end for the time when the edges of the perforation become cicatrized and a gap still remains, but a new impetus may be given to the regeneration by any future affection which causes a hyperæmia in the part and a softening of the cicatricial edges of the perforation.

Treatment of perforation.

Closure of perforation.

Artificial membranes.

In the treatment of a perforation the rule is to close it if possible, on account of the exposure, caused by the perforation of the tender mucous membrane of the tympanic cavity to cold air or water, dust and other foreign bodies. These by their irritation may cause a purulent discharge, and that being once present may lead to results of the most disastrous nature. But if the perforation have existed some time, and be of a considerable extent, the question arises whether the closing of the perforation will not impair the patient's hearing power, and before doing anything to close such it is advisable to temporarily close the gap by a drop of glycerine or other thick fluid and note the effects. Should the result be to lessen the hearing power to any considerable extent, you must carefully consider the probabilities before determining upon your action. While the affection is still in the acute stage, the keeping of the parts clean by gentle injections, and the use of some slight astringents for the purpose of reducing the secretion of the membrane and bringing it into a more normal condition, are all that are required, with the use of a little wadding in the ear when the patient goes out, unless the weather is very mild, when the latter may be dispensed with. Should discharge be present which by some means has become thickened, and by its presence closes or tends to close the Eustachian tube, Politzer's operation ought to be done now and again; and if this is not sufficient of itself the softening of such an accumulation by an alkaline solution as bicarbonate of soda ʒss—ʒj to an ounce of water, and then the Politzerization will suffice to remove it. Should you determine to try to close a large perforation you carefully and gently stimulate the edges of the perforation by the application to them of nitrate of silver or other irritant, either in solution or by touching the moistened edges with a thin layer of the crystals placed on a probe as mentioned in the treatment of granulations. But if you fail to close it by the growth of new cicatricial tissue, and yet believe that its closure would improve, or at least not impair, the hearing capability, you may resort to the artificial drum, the success of which in some cases is very great. Numerous modifications of artificial drums have been proposed, but the most simple, most easily applied, and one that is as successful as any other, is a piece of cotton wadding moistened in water and applied over the perforation and lapping considerably over the edges. The difficulty of its use is its first adaptation, but if once applied successfully the patient can adapt it in future for himself more truly and quickly than his medical attendant. The conclusion as to whether it will be of benefit or not must only be arrived at after several attempts have been made, changing the point of pressure and adapting it more closely to the remnant of natural membrane at different points at each attempt. When it has been used for some time with success the patient feels it very inconvenient to be without it. If found of service, it ought not to be worn above an hour or two at a time for some days, gradually increasing the duration of its application, but always removing it at night, and the patient should be directed to attend to the most perfect cleanliness at each renewal of the wadding.

Artificial perforation of the tympanic membrane.

Artificial perforation of the tympanic membrane.—Having spoken of the means of closing a perforation, it is convenient here to speak of artificial perforation of the membrane. The operation is recommended in cases of accumulations of pus or mucus within the tympanic cavity, of impassable stricture of the Eustachian, of thickening of the membrane, of adhesions of the membrane to the tympanic walls, in cases of tinnitus, and in cases where no benefit is derived after prolonged use of other curative means and the diagnosis is not clear, but the acoustic is not much affected. That benefit may be derived in all such cases cannot be denied, but unhappily we are not yet in a position to say that perforation will benefit this or that case, except in cases of accumulation. The point of operation is determined in cases of accumulation by the point of the membrane at which bulging is present, while in other cases a spot behind the manubrium is usually chosen. Bringing the membrane well into view by the usual method, the operation is made by means of one of the numerous instruments which have been proposed for the purpose. If it is merely as an experimental proceeding, to determine whether an opening will be of benefit to the hearing, or for the purpose of allowing the exit of pus or mucus, a small, plain, double-edged scalpel is all that is required. Having made the opening sufficiently large, you remove all impediments to the passage of sound by causing an air douche to be passed through the cavity by one of the usual methods, having, if necessary, previously softened any accumulations. It being thus empirically determined that a permanent opening in the membrane would be desirable, you attempt to keep the opening from closing by a bougie or Politzer's eyelet, by making the perforation by the galvano-cautery, by removing a part of the malleus with the portion of the membrane, by the constant use of the air douche, &c. But as yet no method has been proposed which acts with certainty of success.

Catarrh of middle ear.

The ordinary *affections of the middle ear* which the general practitioner will be called upon to treat are included under the title of "catarrhal affections," and may be of an acute or chronic character.

Acute catarrh.

The principal objective symptoms of acute catarrh are a hyperæmic swelling of the mucous membrane, with an increased secretion therefrom, the pharyngeal mucous membrane near the orifice of the Eustachian tube leading to the affected ear being nearly always implicated. This state of the mucous membrane gives to the observer who passes a current of air through the Eustachian tube and listens by means of an otoscope, one end of which is placed in the meatus of the patient and the other in his own, sounds ranging from a harsh dry sound, like that caused by distending a dry bladder, to a true mucous râle. The tympanic membrane varies in appearance according to the stage of the affection, from that of a glancing polished copper plate to that of a dull wet bladder, from which all bright reflex has gone, corresponding to the dry and infiltrated states of the tissues. A more or less obliteration of the malleus may be present, depending upon the passage of the exudation between the layers of the membrane. A bulging of the membrane will be observed should an accumulation of fluid have taken place to a considerable extent. The chief subjective symptoms are a pain in the depth of the ear, which is increased by every motion of the parts, such as by coughing or swallowing, an impairment of hearing, a feeling of heaviness, fulness or pressure in the ear, often described as a "drop of water in the ear" tinnitus of various characters, as singing, knocking, or surging, the position of which, whether outside or inside the head, the patient cannot always tell, giddiness, confusion of thought, and other symptoms of pressure. The subacute form is merely a combination of the same symptoms in a milder degree. If the case is properly attended to while in the acute stage no graver disturbances of the organism ought to arise, but it must always be remembered that the tendency of the affection being to thickening and swelling of the membranes implicated, adhesions and solderings are apt to take place between the closely situated delicate structures of the tympanic cavity. The general position of such adhesions is between the manubrium and promontory, the tympanic membrane and incus or stapes, the tendon of the tensor tympani and stapes, and especially often in the niches of the two fenestræ, binding the walls together or to the stapes.

Chronic catarrh.

But should the acute stage be neglected the acute passes into the chronic form, generally, like the acute, implicating both tube and cavity. It may, however, be localised, and consist in repeated swellings with gradual condensations and thickenings of the mucous membrane, which becomes gradually less elastic, and by proliferation form bands in the cavity. These by their physical qualities as well as by their interference with the swinging faculty of the sound-conducting apparatus materially interfere with the hearing capabilities. This chronic form, once established, is most obstinate to treatment, and leads to increase of the deafness, which depends more on the locality of the changes than on their extent. It also causes an increase of the symptoms of pressure, the tinnitus possibly becoming so harassing that persons have been known to have committed suicide to escape from it, and often causing such depression by the effects of the vertigo and vomiting which it occasions that an inclination to resort to intoxicating fluids is thereby aroused.

Prognosis.

The prognosis is generally favorable, but the treatment is prolonged over such an extent of time that the patient frequently ceases to attend before restoration is accomplished, or aid is not sought in time to prevent changes which, having once occurred, cannot be undone. In these cases we must endeavour to stay the course of the disease, which if left to itself will certainly lead to total deafness. The older the patient, the more chronic the affection, and the greater the changes formed in the tympanic cavity, the less hope is there of a good result. If the tinnitus is continuous and has been present for some time, the prognosis is unfavorable, even although under treatment the hearing power is improved, while if nearly total obliteration of the cavity has occurred, especially if chalky deposits are present on the tympanic membrane, a favorable prognosis is almost negatived.

Treatment.

The treatment, besides the constitutional and hygienic, consists in local bloodletting, while the pain and hyperæmia are present, the application of the air douche, the injection of medicaments to the Eustachian tube and tympanic cavity, the treatment of any naso-pharyngeal affection which may be present, and the performance of different operations on the sound-conducting apparatus. Two methods of passing a current of air into the tympanic cavity through the Eustachian tube have been already described (p. 375). The passage of the Eustachian catheter, used either for the conveyance of air, fluids, or vapours, or for the better guidance into and through the tube of bougies, elastic catheters, or instruments for electrical purposes, is by no means so difficult as is generally believed. The silver catheter with an obtuse angle of from 110° to 120°, is, I find, the most generally useful in the hands of those accustomed to pass it. The caoutchouc ones are apt to break after being used some time, and do not convey to the operator such accurate knowledge of the position of the beak in relation to the structures over which it passes as those composed of metal, although the caoutchouc are less likely to make a false passage in the hands of an inexperienced operator. The patient ought to be placed with the external openings of the nares horizontal and opposite to the right shoulder of the operator, who, tilting the point of the nose upwards by the fingers of the left hand, discloses the cavities of the nares more fully, upon the floor of one of which he places the beak of the catheter. Keeping the beak on the floor, he passes it through the cavity and onwards across the pharyngeal space, till it comes against the posterior pharyngeal wall, which, in its normal condition, gives him much the same feeling of resistance which he receives on pressing the catheter against the tense open palm of the hand. Drawing the catheter towards him, and at the same time elevating the end which he holds in his hand, he brings the concave curvature of the opposite end against the posterior edge of the nasal floor, and then turning the beak outwards and upwards, keeping it at the same time against the external lateral wall of the pharynx, he will feel it make a slight dip into the pharyngeal opening of the Eustachian tube. The above method is the one usually adopted, but there is that proposed by Bonnefont, which consists in turning the beak of the catheter from the posterior pharyngeal wall outwards into Müller's depression, and drawing it then towards you till you feel that it has passed over a swelling and then fallen into a depression; or Luweuberg's, consisting of turning the catheter beak inwards after reaching the post-pharyngeal wall, drawing it towards you till the curve catches on the posterior edge of nasal septum, and then revolving it upwards or downwards towards the lateral pharyngeal wall, when it will probably pass into the tube. If there is a difficulty in passing the catheter through the nasal cavity it is generally most easily overcome by keeping the beak towards the external wall and passing along it. But should you fail in passing it through the nostril corresponding to the Eustachian tube, into which you desire to introduce it, by using a catheter with a longer curve you can reach the mouth of the Eustachian tube from the other nostril, or you may pass it into the tube from the mouth. You know that the nozzle has passed well into the mouth of the tube by the position of the catheter not being disturbed when the patient speaks or swallows, by the fact that the nozzle will not pass further upwards, and especially by the fact that on blowing air into the catheter, either by mouth or india-rubber bag, you recognise its

Method of passing the Eustachian catheter.

passage into the tympanic cavity of the patient by having placed a tube of communication from his meatus to your own. In children the outward turn of the catheter is usually more limited in extent than in the adult, in whom it is generally from a fourth to three eighths; but a latitude must be allowed, as the formation of the parts varies. In a new patient, if you wish to pass the catheter into the Eustachian tube, it is advisable to try the right side first, as it will be found usually easier to pass on that side on account of the septum gently inclining towards the left. The mistake generally made is that the catheter is not brought sufficiently forwards after having reached the posterior pharyngeal wall, so that the beak falls into the depression posterior to the opening of the tube. But this may be easily averted by attending to the directions above given as to feeling pressure of the curve on the back of the septum or soft palate before turning the beak outwards.

Method of passing the Eustachian catheter.

Tympanic catheter.

Dr. Weber-Liel, of Berlin, has lately introduced a small elastic catheter for the purpose of securing the passage of injections directly into, or the removal of accumulations from, the tympanic cavity. This is passed through the usual silver catheter as a director to the tube, and having thus, on its exit from the silver catheter, obtained a position in the tube, it is passed on with a little care through the tube and into the tympanic cavity.

The injections passed through the catheter consist of preparations of potass, ammonia, iodine, mercury, silver, zinc, atropine, chloral, &c., in solution, care being taken that the fluid is lukewarm at the time of entrance.

Injections passed into tympanic cavity through the Eustachian catheter.

The following solutions may be found useful:—Sulphate of zinc in varying strengths from one to ten grains, of muriate of ammonia five to twenty grains, of iodide of potassium ten to sixty grains, iodine one to five grains, chlorate of soda five grains, to the ounce of distilled water. Before using them always see that the tube is pervious and cleared of mucus or other removable obstruction to their entrance. They are probably most useful when employed every second or third day, for from three to eight weeks, after which an interval of a month or more of rest is advisable before continuing their application. The injections through the elastic catheter, passing directly into the tympanic cavity, ought to be much weaker.

Should objections be made to the passing of the catheter, so that you cannot use it in passing fluids or vapours to the ear, the instruction of the patient in doing Valsalva's method of inflating the tympanum, by which he may drive steam, impregnated with a little iodine and acetic ether, will serve the purpose. The method of doing so is as follows:—Having placed from ten to twenty drops of a solution consisting of equal parts of tincture of iodine and acetic ether in a quarter of a pint of hot water, the patient inhales a mouthful of the steam, and, having closed the nostrils with the fingers, makes a violent expiration, keeping the mouth and nostrils firmly closed. The steam by this forcible expiration is driven against the walls of the naso-pharyngeal space and mouth, and the Eustachian tubes being the only spot for exit, rushes up these and fills the tympanic cavity, a sensation of fulness, and possibly warmth, being felt in the ear by the patient if the operation has succeeded. This ought to be done several times at a sitting, the patient swallowing between each inhalation. But should the Eustachian tubes not be rendered pervious by the force used, as is not unfrequently the case when the mucous membrane is considerably swollen, the catheter must be resorted to, as by the passage of a current from an india-rubber bag directly through the catheter to the tube an obstruction which will not give way to Valsalva's method will be overcome.

The treatment of the naso-pharygeal space consists in topical application to the mucous membrane of the space of astringents such as alum, tannin, or nitrate of silver. A very useful form is the drawing of a solution of alum up the nostrils, allowing it to pass back into the pharyngeal space, expectorating it, and then blowing the nose violently. When the alum is thought not sufficient for the condition present in the pharynx, a nitrate of silver solution of from ʒss—ʒj to the ℥ of water applied to the pharynx, and especially to the membrane round the Eustachian regions, will be found a valuable agent. The patient being seated so that good light is thrown into the mouth, and the tongue being depressed by a tongue spatula or the index finger covered by a stall, he is desired to take a deep inspiration, at which moment the Surgeon takes the opportunity to pass the brush, which has been dipped in the solution, to one of the Eustachian regions, and, making a half revolution upwards, passes over the whole roof of the space to the Eustachian region of the opposite side. The use of gargles at home between the applications of the caustic is to be recommended.

Nasal douche.

Professor Gruber and others use what is called the nasal douche, by driving from a syringe, the nozzle of which fills one nostril, the other being closed by the fingers of the operator, a current of some astringent solution up one nostril and so into the other, the obstruction to its exit from the other nostril by the fingers regulating the force with which it acts on the pharyngeal walls. But it is so difficult to regulate that force with the resistance of the Eustachian tubes, that the fluid may pass into the tympanic cavity with such a rush as sometimes to do serious damage, and accordingly I would not advise its being applied by those unaccustomed to its use.

Operations on tympanic membrane.

The operations on the tympanic membrane and structures of the cavity are perforation, division of adhesions, and tenotomy of the tensor tympani. The perforation of the membrane has been spoken of at p. 388. The division of adhesions and of the tensor tympani is made by small curved bistouries or by revolving cutting hooks made for the purpose. Those of Weber-Liel, and Gruber, will be found most useful. The determination of adhesions, with their exact positions, is best made by using Siegle's pneumatic speculum, by which, on creating a vacuum in the meatus, you are able to note what part of the membrane is bound down and does not fall into the vacuum with the rest of the membrane. It requires a considerably lengthened experience in aural diagnosis to be certain of the necessity for or advantage to be derived from such operations.

Otitis media.

Otitis media or purulent catarrh is merely a higher grade of inflammatory mucous discharge, but it has always a much more unfavourable prognosis than simple catarrh. The symptoms are much the same as in simple catarrh, but more violent, being accompanied with severe pain, fever, and nearly always leading to perforation. This, should there be an accumulation of considerable extent in the cavity, is to be desired rather than feared; because should the membrane not give way, as is apt to be the case in a thickened membrane from chronic catarrh, the pus is apt to find its way through some of the many passages which often exist between the tympanic and cerebral cavities, and so cause meningitis.

Treatment.

The treatment is conducted on the usual principles. Give the pus every opportunity of free exit, either by natural or artificial channels, and thus allay fever and pain and save time and tissue. Leeches, opiates, purgatives, and warm-water injections into the meatus, keeping the Eustachian open so as to have a natural drain, if necessary, perforation of the membrane at the point of bulging, and when otorrhœa has occurred regular syringing of the ear with lukewarm water, to which an antiseptic or astringent has been added, are what are generally found successful. To make the astringent employed pass into the cavity and through the Eustachian tube it is useful to fill both canals with the astringent, causing the patient to keep it there till you pass a current of air through the Eustachian, on which the fluid in the external canals will rush into the cavity and Eustachian; or by driving a current of fluid with or without medicaments through the Eustachian tube and tympanic cavity from one side or other. In addition to the local treatment that of the constitution must be attended to, the residence of the patient in such chronic discharges being of especial importance.

Purulent catarrh.

The pus catarrh of children is often most insidious in its progress, and may cause great injury before its presence is suspected. Till a discharge appears, probably the ear has not been looked upon as the seat of any disease, on account of the child's inability to localise its pain or tell of its deafness. The screaming of the child when pus has formed is loud and persevering, especially at night, is increased by every movement or concussion of the body, especially by movement of the head, and, above all, by sucking at the breast, which at last becomes so painful that the child refuses to take the breast entirely, preferring to be fed by the spoon. In nearly all the cases of suppuration in the tympanic cavity which come before the Surgeon, the pus has already made its way through the membrane, and the child is brought to you on account of the discharge from the ear. Should you, however, see the child before the pain is relieved, you may by the timely use of the remedies mentioned as useful in otitis media and the free opening of any enlargement over the mastoid process, with, if necessary, opening into the mastoid itself if there be indications of pus-accumulation there, prevent the destruction of valuable structures. The great cause of the affection is scarlet fever, though measles and typhoid fever contribute largely to the number of cases.

Treatment before perforation of membrana tympani.

Treatment after perforation.

When the acute purulent has become chronic there is a wide-spread prejudice amongst both the laity and professional men against the stopping of such a discharge by treatment. This prejudice cannot be too strongly combated, as though in such chronic cases there are generally present slight deafness and only occasionally pain, we can never be certain that complications arising from the constant otorrhœa, such as polypi, paralysis of the facial, ulceration, caries and its results, will not occur.

Affections of internal ear.

Affections of the labyrinth.—The chief symptoms of this class of cases are great deafness, gradually or suddenly acquired, diagnosed by the patient's inability to hear the vibrating fork when placed on the bones of the skull, vertigo, tinnitus, with possibly nausea, vomiting, and pain. The conditions causing such affections are believed to be hyperæmia of the labyrinth or hæmorrhage into it, inflammation of the labyrinth, which is generally in children considered under the term of meningitis, and malignant affections. But affections of the internal ear are much more numerous as secondary affections resulting from an extension of disease of the middle ear, meningitis, fevers, tumours, aneurism, anæmia, hysteria, childbirth, or syphilis. With the latter, arising from hereditary syphilis, are generally seen the syphilitic physiognomy, and in all the cases which have yet come before me in which the acoustic was considerably impaired, changes in the choroid were invariably found if the media were sufficiently clear to allow of a view of the retina being obtained. The treatment, should syphilis be the cause, is not entirely hopeless, but if from other causes is almost nil. Strychnia, quinine, morphia, and local remedies have their different advocates. Electricity may be tried, but a sufficient number of carefully recorded cases is still required before an opinion of its value can be given.

Deaf-mutism.

Deaf-mutism.—By far the majority (above three fourths) of the cases of deaf-mutism arise from congenital affections, the remainder resulting from fevers, teething, hydrocephalus, convulsions, &c. The hereditary influences are undoubted, and when such are present it is often seen combined with retinitis pigmentosa. The pathological conditions found in such are changes in the tympanic cavity with defects in the sound-conveying apparatus, abnormalities in the labyrinth or cerebrum, especially near the fourth ventricle. But the inner ear or cerebrum may have no perceptible changes sufficient to account for such a high degree of deafness as is present. The treatment is the careful cultivation of any remnant of hearing which may be present, and the placing of the child in an institution for the education of deaf mutes, where by the careful watching of the lips of the speaker they are able to follow him in conversation, and by a laborious teaching of the positions in which the organs of speech are to be placed in forming the different syllables, they are rendered capable of answering.

SURGERY OF THE CIRCULATORY SYSTEM.

CHAPTER X.

WOUNDS OF THE HEART AND ARTERIES—HÆMORRHAGE AND ITS TREATMENT.

Wounds of the Heart.

Wounds of the pericardium.

Although it is quite possible for the anterior mediastinum to be traversed from side to side by a foreign body without any important structure being wounded, it is far more common for some severe lesion to be the result, such as a wound of the pericardium, heart, lung or of the great vessels. A wound of the *pericardium alone* may occur, and not prove fatal. Dr. G. Fischer has collected fifty-two reputed cases of the kind, including punctured, incised, gunshot, and lacerated wounds, twenty-two of which recovered. The chief danger of this local injury lies in secondary inflammation of the membrane.

Wounds of the heart. Symptoms.

Wounds of the heart itself are generally mortal, death taking place immediately in about one fourth of the cases; in the bulk of the remainder after a few days; rare instances recovering. The symptoms of a wound of the heart are very uncertain, but the most important one, says Poland, "is the presence of a *lesion* in the neighbourhood of the heart, with *external bleeding*, followed by all the signs of sudden internal hæmorrhage." Sudden *collapse* is a very general consequence of the injury, and when it comes on some time afterwards, it is probably due to secondary hæmorrhage, from the giving way of the clot in the wounded heart. *Dyspnœa*, according to Fischer's Analysis, is not constant, and, when present, seems to be due to compression of the heart by the effusion of blood into the pericardium and pleura. In some cases it is immediate and intense. The *pulse* is often unequal, small and intermitting. *Pain* is uncertain. The position of the external wound is a valuable aid to diagnosis, and it is well to remember that the sternal end of the second left intercostal space corresponds to the left side of the base of the heart, and the lower margin of the fifth rib to the apex. In a medico-legal sense it should also be known that "when a person is found dead with a wound in the heart, attended with abundant hæmorrhage, it must not be supposed that the flow of blood took place in an instant, or that the person died immediately, and was utterly incapable of exercising any power." (Taylor.) The symptoms as well as the duration of life are much influenced by the direction and size of the wound. Thus, if made in the course of the muscular fibres there will be little or no hæmorrhage, and consequently less collapse, dyspnœa, &c. &c.; but if the heart be cut across, the edges will separate to a great extent, and sudden death occur from the immediate gush of blood. In oblique wounds there will be less gaping of the edges. With respect to the cases of recovery, Sanson has recorded an instance in which a

Collapse.

Dyspnœa.

Pulse.

Diagnosis.

Duration of life.

cicatrix in the heart was found some lengthened period after a wound, from which the patient had recovered in twenty-eight days. Velpeau has cited a second, of a man, aged fifty, who died nine years after having received a wound in the left side of the chest from a table knife, and in whom the pericardium was found largely opened and adherent to the parietal cicatrix, and fibrous lines traversed the whole thickness of the right auricle, at a point corresponding to the breach of surface in the pericardium. The heart may also be lacerated by a severe contusion or pressure upon the chest without external wound or fracture of the ribs.—(A preparation in the Royal College of Surgeons of Edinburgh proves this point.)—The diagnosis and treatment of this form of injury are the same as in cases of wounds.

Laceration of heart without external wound.

Treatment of wound of heart.

Treatment.—As hæmorrhage is the main fear after a wound of the heart, so to prevent and arrest it should be the Surgeon's chief aim. To do this, absolute repose is essential, and this should be maintained throughout the case. The local and general employment of cold should also be advised. To calm the excited action of the heart belladonna and digitalis have been recommended, and so even has venesection. When the pericardium is full of blood, it has been suggested to lay open the cavity to let it out, but the uncertainty of diagnosis is sufficient to forbid the attempt. The diet should be nutritious, but unstimulating. For further information on the subject I may refer to Poland's article in 'Holmes's Surgery,' which contains an admirable analysis of Fischer's paper; also to a paper by West in the 'St. Thomas's Hosp. Rep.,' 1870.

Wounds of the large vessels of the chest.

Examples.

Wounds of the large vessels of the chest are generally fatal, death being, in most cases, immediate from internal hæmorrhage. Dr. Heil, however, records a case in which a man after receiving a stab which penetrated the aorta recovered, and lived a year. Pelletan also cites another, in which a man was run through with a foil, which entered the chest above the right nipple, and came out at the left loin; in it no violent nor marked symptoms followed the accident beyond constant pain in the loins. Two months later he died somewhat suddenly, in great agony, from hæmorrhage into the right side of his chest, and after death, an opening, the size of a quill, was found in the aorta above the diaphragm. The Hunterian Museum (No. 1565a), contains a specimen of the ascending aorta of a sailor, in which was lodged a bullet in a piece of integument surrounded by lymph. The wound was produced by a musket ball passing through the diaphragm and pericardium into the aorta; it entered the chest between the eighth and ninth ribs, and was followed by a rush of blood; very soon, however, all hæmorrhage ceased. The man lived three days after the injury.

On Wounds of Arteries.

On wounds of arteries.

Complete division.

Partial division.

When an artery is *completely cut across* bleeding takes place, the blood jetting forth *per saltum*, as it is called, with each pulsation of the heart. The blood is usually of a bright red colour, unless the patient be asphyxiated, or fully under the influence of some anæsthetic, when it is often as black as venous blood. Pressure upon the vessel above the wound arrests or diminishes the hæmorrhage, and pulsation in the vessel below is lost. When, however, an artery is *only partially wounded*, either transversely, obliquely, or longitudinally, bleeding will still take place, though it will probably be less profuse; the blood rarely jets out as from a divided vessel, unless the wound be very large, but wells up *in a deep wound*, or flows out in a continuous stream, after the manner of venous blood. When red its arterial nature can be easily recognised, but when black its recognition is more difficult; should pressure above the wound arrest the flow and pulsation in the vessel below be lost, the probabilities of the blood being arterial are strengthened. It must be remembered, however, that when a large artery is partially divided just *below* a large anastomotic branch, bleeding will take place from the lower end of the wounded artery as well as from the upper, while pulsation in the vessel below will only be diminished. This is an important fact to bear in mind.

Escape of blood may be continuous and colour black.

Bleeding from lower end of artery.

When hæmorrhage takes place from a large vessel it is generally so profuse as to destroy life rapidly unless instantly checked. When from a small one it is less copious, and has a natural tendency to stop, at any rate for a time, and to give an opportunity for natural hæmostatics to take effect. It will be well, therefore, to consider how wounded arteries heal, and by what means bleeding is naturally arrested.

Repair of wounded arteries.

Primary adhesion.

Healing by granulation, after Paget.

Small wounds of arteries may, doubtless, heal by immediate union or primary adhesion, and larger ones may likewise for a time be closed by the clot of blood that covers the wound, or even by some stronger reparative material; but "the closure is often ineffectual, or only for a time, and fresh bleedings ensue, either increasing the accumulation of extravasated blood or pushing out the clots already formed. In this way, with repeated hæmorrhages at uncertain intervals, the wound in an artery is often kept open, and at the end of two or three weeks may show no trace of healing, but rather appear widened and with softened everted edges. In such a case it is possible that the wound in an artery may still *heal by granulations*, either rising from its edges or coalescing over it from adjacent parts; but the *event is too unlikely to justify the waiting for its occurrence*, if there be opportunity for surgical interference, and even if healing should go so far as to close the opening in the artery yet it is likely to be insecure, for both the elastic tissue and smooth fibred muscle, on which its strength largely depends, are very slowly formed in scars. Hence, a form of traumatic aneurism seems not very rare, in which the sac is chiefly formed of scar-tissue, which closed the wound in the artery and then yielded to the pressure of the blood."—Paget, 'Lectures,' p. 204, ed. 3rd.

Partial division of arteries more serious.

Hence a partial is more serious an injury than a complete division of an artery, and requires as prompt surgical treatment; for the means adopted by nature for the permanent arrest of bleeding in a divided vessel are acting at a disadvantage in one only wounded and are rarely effectual; thus in practice it is often the object of the Surgeon to complete the division of a partly divided vessel, and give natural hæmostatics a fair chance of effecting a cure. From vessels of small size hæmorrhage, as a rule, ceases after the first rush or, at any rate, as soon as nature's processes for controlling bleeding have had time to act. Indeed, "gradually, with or without surgical help, all the vessels divided by a wound are closed and cease to bleed; the larger being often aided to this end by their retraction among the looser textures, and by the coagulation of the blood within or over their orifices, and by the diminution of the heart's force with the increasing loss of blood. Coincidently the flowing blood becomes gradually brighter and paler. And, if the wound be left open after pure blood has ceased to flow, there is an oozing of blood-tinged serous-looking fluid; and this is gradually succeeded by a paler fluid, some of which collects like a whitish film on the surface of the wound."—Paget.

Conditions favorable and unfavorable to hæmorrhage.

Whatever favours retraction of a divided artery and its contraction, tends to arrest bleeding; whatever hinders these processes prolongs and increases it. Thus, vessels that traverse loose textures cease bleeding more readily than others circulating through those that are close and compact, such as the integument of the head, and sole of the foot, and bleeding from an inflamed part or rapidly growing tissue is checked with greater difficulty than from parts differently situated.

Punctured wound of artery.

Oblique wound of artery.

The size and form of the wound in the vessel has also much to do with the result. A *puncture in the axis* of a large artery may heal by natural processes, and be unattended by much bleeding. A small *vertical* wound may likewise close. An *oblique* wound will gape and is, consequently, attended with copious bleeding, while a *transverse* wound is of all others the most dangerous on account of the difficulty of controlling hæmorrhage and the improbability of natural hæmostatics unassisted by art acting with any permanent advantage. The retracting power of the vessel tends to cause gaping of the wound rather than closure, and encourages rather than checks bleeding.

Natural hæmostatics.

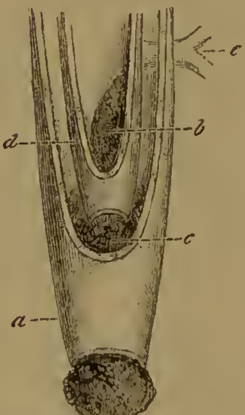
Natural Hæmostatics.

Effects of complete division of artery.

Means of arresting hæmorrhage.

When an artery is divided across five things happen. (1) The divided ends (fig. 102 *d*) *retract* within the sheath, and (2) by *contracting* diminish the calibre of the canal. (3) Blood coagulates *in the sheath* (*a*) around the orifice of the divided vessel; and (4) *in the artery* itself (*b*) up to the first large branch; and, lastly (5), *plastic lymph* is poured out from the divided coats of the vessel, and by its organization the permanent closure of the vessel takes place. The clot subsequently becomes organized and the vessel contracts. In a large proportion of the cases of divided arteries these natural hæmostatic processes are ample of themselves for the arrest of bleeding; and it is only in the larger arteries that any surgical or artificial aids are required. These to be good must be based on the self-same processes, and are to be looked upon simply as aids in giving time for the physiological methods to take effect; and in so far only as they aid and do not interfere with the due action of these is the value of the surgical interference to be estimated.

FIG. 102.



Natural hæmostatics.

Exposure of artery and the application of cold.

Pressure.

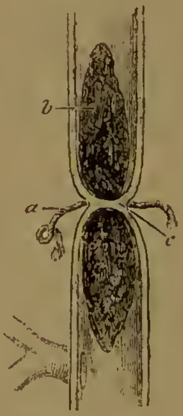
Thus, the *exposure of, and the application of cold to,* a divided artery favour its contraction: this physiological fact explains the practical one,—that on the free opening of a wound, hæmorrhage so often ceases never to return. *Pressure* upon the end of a wounded artery favours coagulation in the vessel, and the value of *acupressure* rests mainly upon this principle, as the pins mechanically arrest the flow of blood, Ligature.

whilst coagulation is taking place in the vessel up to the first branch. The application of a *ligature* is based upon the same kind of knowledge as well as the practice of torsion. It will be well, therefore, to consider briefly how these artificial means act.

On the action of ligature: Stilling's and Jones's views.

To Stilling and Dr. J. F. D. Jones we are indebted for most of our knowledge upon these points. *When a ligature is applied to an artery* the inner coats are usually more or less regularly divided, and the outer coat is so constricted as to arrest the current of blood through the vessel. The blood that is arrested consequently coagulates and forms a clot, or thrombus, which is, as a rule, conical, with its base towards the ligature, and apex pointing to and reaching the first branch. (Fig. 103 *b*.) This clot subsequently contracts and becomes organized. The inner and middle coats pour out round about the line of their division by the ligature (*c*) plastic lymph, which heals the wound, and cements the outer, inner coat, and clot together into one homogeneous mass. The outer coat, constricted by the ligature, sloughs or ulcerates through, allowing the ligature to be removed, and it is this action that too often tends to undo what Nature had otherwise well done by the processes above described, and gives rise to secondary hæmorrhage. It is this fact which makes the practice of arresting hæmorrhage by means of the ligature so unsatisfactory.

FIG. 103.

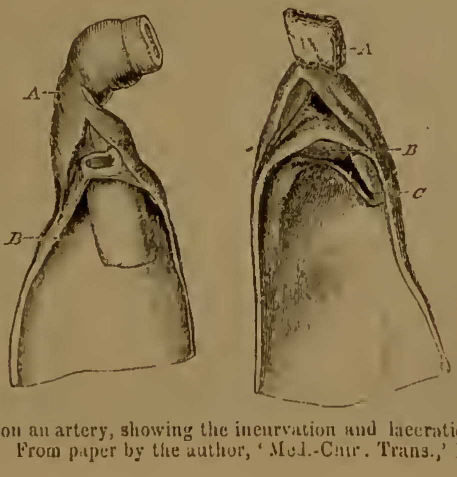


Effects of ligature on an artery.

On the action of torsion.

When an artery is closed by what is termed *Torsion* the inner coats are ruptured (Figs. 104 B and C), and the outer coat (A) closed by the twists to which it has been subjected when not twisted off. But the inner coats, instead of being simply divided in a linear manner, such as occurs in the ligature, are ruptured, separated from the outer coat, and incurved, their divided ends turning into the

FIG. 104.



Effects of torsion on an artery, showing the incurvation and laceration of the inner coats. From paper by the author, 'Med.-Chir. Trans.,' 1868.

vessel, and in the most perfect examples forming complete valves, not unlike the semilunar valves of the heart. The blood, which is consequently arrested by this valvular incurvation of the inner tunic, undergoes changes precisely similar to those already described. Plastic lymph is poured out by the divided tunics in the same way as it has been shown to be in the application of the ligature, and it acts the same part in cementing all the arterial tunics and clot together; but between the two forms of practice there is this difference, that where the ligature has been used, ulceration of the vessel is necessary to allow of its escape, and this may undo all that Nature has done to seal the artery and prevent hæmorrhage; whereas, when torsion has been efficiently performed and the hæmorrhage arrested, no subsequent action is liable to undo the good work that has been done or hinder the permanent closure of the vessel.

In both ligature and torsion, natural hæmostatics are aided in their work; but in the former, the ulceration set up by the ligature may materially interfere with the perfection of the process; in the latter, there is nothing to prevent the process going on to its completion.

The antiseptic ligature.

The carbolised catgut ligatures, as introduced by Professor Lister, are valuable agents for the arrest of bleeding in divided vessels, but they are to be regarded as temporary ligatures, for they either dissolve within a few days of their application or unbind; they are not, therefore, so safe as torsion, for if the end of the artery to which such a ligature has been applied has not become permanently closed by natural hæmostatic processes before the catgut ligature has dissolved or loosened, secondary hæmorrhage may take place, and this accident has occurred in my own practice. The catgut ligature is, however, a safer ligature for divided arteries than the silk or hempen, for it does not, like the latter, of necessity, require an ulcerative process for its discharge.

On lacerated arteries.

When an artery is torn across, even a large one, bleeding rarely takes place. I have seen the femoral and brachial torn asunder and no bleeding follow, the lacerated vessel appearing under those circumstances as if drawn out, the elastic external tunic being stretched into a conical form over the inner coats that have been divided and have retracted. Bleeding is arrested by the drawn out external tunic and the sheath, the divided and broken up inner coats probably assisting somewhat as in torsion. The knowledge of the above fact, indeed, suggested to Amussat the idea of practising torsion of an artery. An artery divided, therefore, by laceration or torsion, however large, rarely bleeds.

On contused arteries.

Contused vessels are occasionally followed by hæmorrhage, that is, when the injured part has been so damaged as to cause it to slough. Such a result is, however, rare in civil practice; in military, from gunshot wounds, it is more common. The bleeding under such circumstances occurs after the fifth day. A severe contusion may, however, lacerate or break up the inner tunics and thus cause their separation from the external cellular coat and the subsequent closure of the vessel. It is probable that this is the usual mode in which an artery becomes impervious after a contusion. I have known the common femoral artery, the axillary, and the brachial artery to become permanently closed after a local contusion, and Mr. Moore has recorded a case in which the inner coats of the common iliac artery were partially detached from the outer coat and inverted downwards after a blow upon the part.

Occlusion often contusion.

It is a question whether as a result of contusion adhesive inflammation ever takes place in an artery to cause its occlusion without some laceration of its inner tunics.

Secondary subcutaneous hæmorrhage.

Sometimes a vessel will give way in a part that has been severely contused some days after the injury, causing a secondary subcutaneous hæmorrhage, and the vessel may rupture with the sensation of something giving way. Cold lotions will, as a rule, suffice to induce absorption of the blood, although in some cases the fluid blood may be drawn off with a good result.

On Hæmorrhage and its Treatment.

On hæmorrhage.

When bleeding takes place rapidly from a wound after an injury or operation, it is called *primary;* when it occurs within twenty-four hours, or in rare cases within two days, it is called *recurring or intermediary,* and when after a lapse of a longer period *secondary.*

Primary.

Recurring.

The *primary* is due to the direct injury of the vessel; the *recurring* to the increased force of the circulation during reaction, and the displacement of clots that were sufficient to seal vessels when the circulation was feeble, to the overlooking of a vessel during the dressing of a wound, or to some imperfection in the mode of securing it at the time of operation. The *secondary* is caused by the giving way of an artery or vein; by ulceration of the ligature; sloughing of the vessel, alone or with the tissues around; the accidental separation of a ligature; injury; or by the hæmorrhagic diathesis.

Secondary.

Symptoms of external hæmorrhage.

When blood escapes from a wound externally, or into a cavity, the term *hæmorrhage* is applied; when beneath the integuments or amongst tissues, *extravasation* and *effusion.*

The symptoms of external hæmorrhage require no description; the slow flow or the sudden gush of the life's blood may be recognised by all. Those of internal hæmorrhage or extravasation require, however, some little attention. They are those of local injury, *plus* those general symptoms which denote hæmorrhage generally.

Bell's description of dying by hæmorrhage.

"In slow and in sudden hæmorrhages," wrote John Bell seventy years ago, "the symptoms are very different. In the former the patient is very slowly exhausted; at each return of bleeding the patient faints, and is laid in bed, and the cold applications and the fainting save his life. He rises, after some days, pale, languid, and giddy. The pulse flutters, and is hardly to be felt; the breathing is quick and anxious, accompanied with sighing and great oppression; the heart palpitates on the slightest motion; and the slighest inclination of the head, or rising suddenly from the couch, endangers fainting. The voice is low; the eye is languid, colourless, and of a pearly white; the flesh feels soft and woolly, and the skin is pale, yellow, gelatinous, and, as it were, transparent, like modelled wax. After this stage of weakness the blood loses its colour; from this time forward it is a bloody serum only that distils from the vessels; dropsy appears, and the slightest loss of blood proves fatal. But when the patient expires suddenly by an impetuous bleeding from some great artery; when he dies of the bleeding from a femoral aneurism; when he is wounded among the viscera, and some great vessel is pouring out blood, the blood in the general circulation, in place of being forced onwards by the contractions of the arteries, runs backwards towards the wound from all parts of the body. The arteries no longer push on the contents of the veins;

the blood ceases to flow towards the heart; the heart ceases to act; and the countenance assumes, as in asphyxia, a livid hue from want of circulation. The face becomes all at once deadly pale, the circle round the eyes is livid, the lips are black, and the extremities are cold. The patient faints, revives, and faints again; with a low and quivering pulse; he is sick; and his voice is lost. There is an anxious and incessant tossing of the arms, with restlessness, which is the most fatal sign of all. He tosses continually from side to side; his head falls down in the bed; he raises his head at times suddenly, gasping, as it were, for breath, with inexpressible anxiety; the tossing of the limbs continues; he draws long convulsive sighs; the pulse flutters and intermits from time to time, and he expires. The countenance is not of a transparent paleness, but of that clayey and leaden colour which the painter represents in assassinations and battles; and this tossing of the limbs, which is commonly represented as the sign of a fatal wound, is indeed so infallible a sign of death that I have never known any one recover who had fallen into this condition." ('Principles of Surgery,' vol. i, page 143.)

This sketch is so graphic that I have extracted it as a whole. Since my student's days, when I first read it, it has been fixed in my memory; it is, however, but a page out of the work of a master Surgeon which still deserves close study. A patient may lose a large quantity of blood and yet rally. Children bear the loss of blood badly, but rally quickly. In old age a small hæmorrhage is of grave importance, the rallying power being poor.

The Local Treatment of Hæmorrhage.

Local treatment of hæmorrhage.

Hæmorrhage from any vessel, however large, is readily controlled by the application of well-applied direct pressure *upon the wounded part*, consequently any Surgeon on being called to a case of wounded artery, having cleansed the wound and exposed the vessel, should put his thumb or finger on the bleeding orifice and check the flow. No mere covering up of the wound to smother the hæmorrhage will be found of any avail. When moderate bleeding comes from a wound and its source is unknown, whether arterial or venous, the first duty of the Surgeon is to *clean the wound and remove clots*. This act alone is often sufficient of itself to arrest bleeding, not only for the time but permanently. The parts should at the same time be elevated and left exposed for a few hours.

Direct pressure.

When the bleeding is venous *the elevation of the limb* has a most beneficial and rapid action. In amputations, before the application of the tourniquet, as well as after its removal, the limb or stump should always be elevated for a few seconds to empty the veins. When well applied, *direct pressure* stops the flow of blood, and when such means appear to the Surgeon to be sufficient for the treatment of the case, some care should be employed in its application. The first pad to be applied to the bleeding part should be a small compact one, corresponding in size to the last joint of the thumb; a larger one should be placed over it and carefully adjusted, a third covering in the whole; these are to be firmly bound down over the bleeding vessel with a bandage or some unyielding strapping, care being observed that the pressure employed is sufficient to control the bleeding, but not enough to arrest wholly the circulation through a limb, and produce gangrene of the parts below.

Indirect pressure.

When direct pressure is inapplicable, *indirect pressure,* as it is called, or pressure by means of a tourniquet applied to the main artery of a limb above the wound, may be employed; and in operations upon the extremities this is the best mode of preventing or arresting hæmorrhage, the tourniquet being accurately applied over the main artery of a limb, but not screwed up till the operation is about to be commenced.

For mere temporary purposes the main artery may be compressed by the finger of the Surgeon or of a skilled assistant; but for a lengthened period this method is untrustworthy, it being impossible for any ordinary man to maintain firm pressure upon a vessel for more than a few minutes consecutively; but the use of the weight as shown in Fig. 114 may be recommended. As a temporary means, however, of arresting bleeding, manual pressure is of immense value; for the lower extremity it should be applied to the femoral artery below Poupart's ligament; for the upper extremity on the inner side of the biceps muscle, the fingers or thumb of the Surgeon being employed according to convenience.

Esmarch's method.

In recent times, what is known as Esmarch's method of arresting hæmorrhage has met with good support; it consists in applying an elastic bandage from the extremity of the limb to be operated on to a point above the site of the operation, and the application of an india-rubber band, tube, or elastic bandage tightly above the upper border of the first elastic bandage, which may then be removed. By this method the parts below the band have been rendered bloodless, and the Surgeon may explore a limb, excise a tumour, joint, or bone, and even amputate, with the loss at the time of a mere spoonful of blood.

Objection to method.

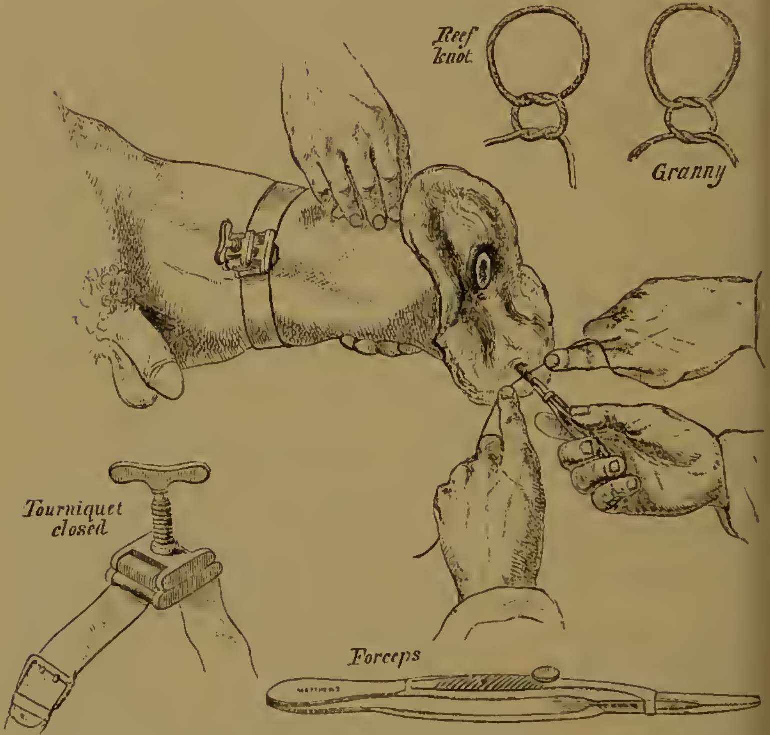
The method has, however, this objection—that when the band is removed blood oozes from the soft parts to a far greater extent than is the case under other circumstances, the smaller vessels apparently becoming paralysed by the compressing bandage, or from their having been completely emptied. The operation, which is bloodless during the cutting process, on the whole, is therefore followed by the loss of as much blood as generally follows other methods. For exploratory operations and the removal of small foreign bodies, excision of joints, and removal of necrosed bone, it has, however, great advantages. For amputations I never now employ the bandage to the limb. I elevate the limb to empty it of venous blood, and with the hand press the blood upwards. I then use the elastic band as a tourniquet. I have found that by this method all the advantages of Esmarch's plan are secured without the disadvantages.

The elastic bandage is a better tourniquet than the india-rubber tube; indeed, it is better than any other.

The tourniquet.

The tourniquet is, without doubt, the best instrument to use for the compression of an artery, and J. L. Petit's or Esmarch's band is, probably, the best for the extremities. The former is to be applied to the limb directly over the vessel to be compresssd, the pad being adjusted in the axis of the vessel. The ends of the band are then made to pass round the limb and secured either by a buckle or a knot, the former being the better. The two plates are then to be separated by the rotation of the screw, and a sufficient amount of pressure employed to stop the current of blood, but no more. (*Vide* Fig. 105.) Lister, of Edinburgh, has invented an admirable tourniquet for compressing the abdominal aorta, and many others have been made, but the two named are ample for all ordinary purposes of arresting or preventing hæmorrhage. When a tourniquet is not at hand, as in the field, a stone or any hard substance may be rolled up in a handkerchief applied over a vessel, and bound round the limb; the ends of the handkerchief should be attached to a stick or sword, any amount of compression being obtained by simply twisting the stick or sword.

FIG. 105.



As *temporary* means, therefore, of arresting hæmorrhage, pressure upon the bleeding spot,—*direct*—or upon the main artery of the part, —*indirect*—digital or instrumental is the most reliable; the wound in both cases being well exposed and cleansed, and all coagula removed preparatory to the application of such permanent means as the Surgeon has at his command. Of these, the *ligature*, *torsion*, and *acupressure* are the chief. Styptics and the cautery are employed only when the three means mentioned are either inapplicable or have proved unsuccessful.

On the use of the ligature.

On the use of the Ligature.

Since Ambrose Paré reintroduced the use of the ligature (1550), it has been the favourite means in the hands of most Surgeons for the arrest of hæmorrhage; the speedy way in which bleeding from an artery, however large, is checked by its application, and the feeling of relief that a Surgeon experiences on knowing that for a time, at least, all fear of bleeding has been removed, have so influenced the majority of men in its favour as to induce them to put aside untried all other means that have been suggested, as being unnecessary. It took, however, more than two centuries for the ligature to become established in practice; in fact, its adoption was not general till Jones by his experiments already alluded to (p. 401) had proved to the profession the physiological processes by which hæmorrhage is naturally arrested in a bleeding vessel, and that by the ligature these were imitated.

In a former page the way in which the ligature is supposed to act has been explained, and the weak points in the practice have been noticed.

Mode of ligaturing.

To tie an artery efficiently the vessel should first be taken up cleanly and drawn out. A smooth round cord of silk, hemp, or catgut, should then be applied firmly around its extremity; sufficient force being used to cause rupture of the inner coats of the vessel—this result, although desirable, however, does not appear to be constant with the ligature—and occlusion of the outer coat, a knot called the Surgeon's or sailor's reef knot being employed. In forming the knot the loop of the ligature should be pressed down to the artery by the finger or thumb of the Surgeon, as indicated in the drawing (Fig. 105), otherwise the extremity of the artery will be liable to be broken off, particularly when diseased.

When the vessel is deeply placed and cannot be isolated, it must be ligatured with some of the adjacent tissues. When it is so embedded that its free end cannot be taken up with forceps, a tenaculum may be passed beneath the bleeding vessel, and all the tissues taken up by the instrument strangled by the ligature. The ends of the ligature are left hanging out of the wound. Of late years, Mr. De Morgan has been in the habit of cutting off both ends of the ligature, leaving the knot in *sitû* and closing the wound, this practice being a revival of an old one of the last century, and when Mr. Lister's catgut ligatures are employed the same practice may be adopted. Good results have followed this practice, in my hands as with others, when catgut has been employed, the carbolized catgut being a good temporary ligature.

De Morgan cuts off both ends.

Ligature of diseased arteries.

When the vessels are diseased and brittle some care is needed in the application of the ligature; the vessel should not be tied too tightly lest too much of the artery be torn, and the ligature separate before natural hæmostatics have closed the vessel. Some Surgeons have suggested the use of a flat ligature under these circumstances, but it seems scarcely needed. In 1865 I was called upon to apply a ligature to the femoral artery of a man over seventy years of age for femoral aneurism, and the vessel was so brittle that I felt the coats give way on the application of the ligature, and the included tissue seemed to be so thin that I expected to find the ligature come away in my hand; in this, however, I was disappointed. The case ultimately did well, no bleeding having taken place.

Mode of separation of ligature.

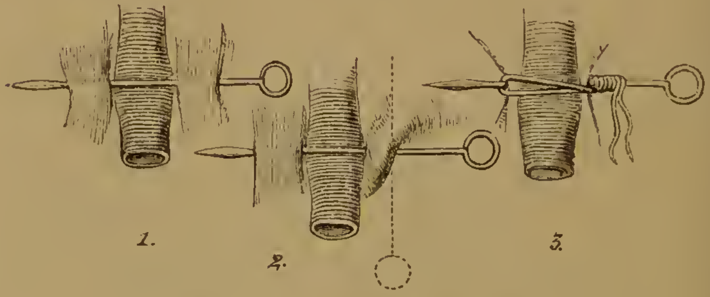
The mode in which a ligature comes away demands a passing notice, for it is important. In a large number of cases it is by ulceration, but in as many the ligature causes sloughing of the vessel, at the seat of its strangulation, and a ring of artery comes away in the loop of the ligature. In both cases a solution of continuity takes place as a secondary result of the strangulation of the vessel, and unless a firm clot has sealed the artery at both ends or plastic lymph has become organized around the divided coats, the probability that hæmorrhage will take place is very great. The carbolized catgut ligature is said, however, to become incorporated with the tissue of the artery or to dissolve, and not to excite ulceration, as do other ligatures.

On acupressure.

Acupressure.

The late Sir James Simpson brought this method of arresting hæmorrhage before the profession in 1860, and upon his authority many men put it into practice. Drs. Keith and Pirrie, of Aberdeen, have given it their warmest support; indeed, at the present time in Dr. Pirrie's hands it alone is employed as a general way of arresting hæmorrhage. The principle of the practice is very simple,—it is the occlusion of the artery by the temporary pressure of a pin, without lacerating the vessel or setting up inflammatory and suppurative action as by the ligature. The pin is removed on the second or third day, according to the size of the artery, and the advantages thus claimed for it are very great, but experience has not yet decided in its favour. There are three leading forms of acupressure.

FIG. 106.



Different modes of applying acupressure.

In the *first* the artery is directly compressed between the pin, which crosses its free end, and the muscle beneath (Fig. 106, 1).

In the *second* the same result takes place, the pin being made to give a half twist through the tissues between its first and second insertions (Fig. 106, 2).

In the *third* the pin is simply passed beneath the vessel and pressure applied to the artery by means of a loop of wire or silk looped over its point and made to cross the vessel, the ends of the loop being secured upon the shaft of the pin (Fig. 106, 3).

Its value and drawbacks.

The *good* point in acupressure is the absence of any foreign body for more than a few hours or days. Its disadvantage lies in the fact, that its success depends upon the coagulation of the blood in the vessel down to the first branch, one of nature's temporary hæmostatic processes, and not upon the permanent closure of the coats of the vessel; as a consequence it is not so secure as the ligature, or physiologically so sound as the practice of torsion. As a general mode of arresting hæmorrhage it seems improbable that it will hold its ground, indeed it is but little practised at the present time. It is, however, a valuable mode of temporarily arresting hæmorrhage in certain cases where the ligature and torsion are inapplicable, as in wounds of the palm or the sole of the foot; it is particularly valuable also as a means of arresting the flow of blood from a leech bite or other bleeding point, the passage of a needle through the skin, and a figure-of-8 ligature over being of great use.

On Torsion.

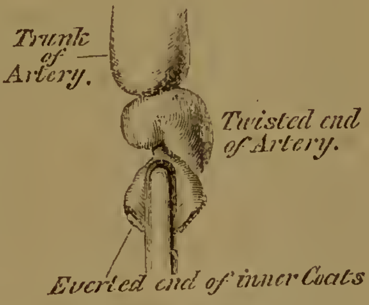
On torsion.

In a physiological point of view there is no method at the Surgeon's command more perfect for the control of hæmorrhage than that of torsion; for unlike acupressure, which uses one only of Nature's hæmostatic processes, or the ligature, which is a foreign body in a wound, and becomes a source of danger by undoing at a later period of the case what has been done at an earlier by Nature's own efforts, it utilises to the utmost all the physiological processes employed by Nature to prevent and arrest bleeding, and places them in the most favorable position to take effect. What these changes are was shown at a former page of this chapter.

Mode of performing torsion.

For the application of torsion a good pair of forceps is required (*vide* Fig. 105), one that will hold the end of the artery firmly, that has no lateral motion, and with serrations blunt enough to obviate any laceration or cutting of the parts seized by the blades. The vessel should then be drawn out, as in the application of the ligature, and three or four sharp rotations of the forceps made. In large arteries, such as the femoral, the rotation should be repeated till *the sense of resistance has ceased.* The ends should not be twisted off. In small arteries the number of rotations is of no importance, and their ends may be twisted off or not as the Surgeon prefers. In Fig. 107 the appearance of a femoral artery sufficiently twisted is well shown. When the vessels are atheromatous or diseased fewer rotations of the forceps are required, the inner tunics of the vessels being so brittle as to break up at once and incurve. Should the Surgeon, therefore, twist more he will break away the external or cellular coat that is of essential importance in maintaining the lacerated inner coats in position, and in allowing blood to coagulate between their septa, and lymph to organize. With this caution diseased arteries appear to be as amenable to this treatment as the healthy, and torsion requires no more care under these or any circumstances than the application of a ligature.

Fig. 107.



Effects of torsion on femoral artery.

Arguments in favour of torsion.

The physiological arguments in favour of torsion are very great, and the practical advantages seem to be no less. After seven years' experience of the practice applied to vessels of all sizes, the femoral being the largest, I have had no mishap. I have observed that wounds have united more rapidly and kindly; primary union being the rule; there has been less constitutional disturbance after operation, and consequently less liability to traumatic fever, pyæmia, and other complications such as we are all too familiar with in the practice of surgery.

I have had stumps heal in a week, and patients up in two weeks, without one single drawback; rapid and uninterrupted convalescence following the operation. In other cases equally good success can be recorded. At Guy's Hospital up to 1874 we have had 200 consecutive cases of amputation of the thigh, leg, arm, and forearm, in which all the arteries had been twisted (110 of them having been of the femoral artery) and no case of secondary hæmorrhage.

Statistics of torsion.

Webber's forceps.

Mr. Webber has invented an ingenious pair of forceps for dividing the inner coats of an artery in an irregular way, and thus arresting hæmorrhage. They are made by Maw. The principle upon which they act approaches that of torsion, and Dr. Fleet Speir, of New York, has had an artery-constrictor made, which appears to have the power of dividing the inner coats and allowing them to incurve, as in torsion. I have tried it, and think it may be useful for obstructing arteries in continuity, as for aneurism. ('Med. Mirror,' New York, April, 1871.) For divided vessels it has no advantage over torsion,

On styptics and astringents.

Astringents or styptics are likewise valuable agents in the arrest of bleeding, when the means previously mentioned are inapplicable; combined with pressure, their value is much increased. The perchloride or persulphate of iron, pounded matico, alum in powder or solution, applied to a bleeding surface on a pad of lint or dossil of cotton-wool, and bound on, are the best applications; but tannic acid, Ruspini's styptic, or oil of turpentine, are also good. Before applying any of these the bleeding part should be wiped as dry as possible, and all coagula should be removed. In uterine surgery injections of some of these astringents are much used. In rectal surgery the bowel may be plugged with lint or sponge saturated with a styptic, and in epistaxis the nose may be plugged with the same.

Cold is a powerful styptic, cold air often permanently arresting even copious hæmorrhage on laying open a wound. A stream of cold water directed on a bleeding part, or ice pounded and placed in bladders or bags and then laid on bleeding wounds, are at times of great assistance.

On cauterization.

Cauterization, although the common mode of arresting bleeding by the ancients, is now seldom employed; yet it is a valuable agent in cases where neither torsion, ligature, nor acupressure, is available. In spongy tissues from which blood is oozing, or even in other cases, the hot iron will often act most beneficially. It may be applied through iron buttons or cones brought to a *black heat* by means of fire, or through platinum or porcelain instruments heated by means of gas or the galvanic battery. In both cases the heat should be enough to cause a dry eschar upon the bleeding part, and care should be exercised subsequently not to remove this too soon; indeed, the eschar or scab should be left for natural processes to throw off. The cautery should in no case be too hot, that is *red hot,* as it destroys the vessels too much; it should be of a *black heat.*

Capillary hæmorrhage.

Hæmorrhage from the *capillaries,* or small vessels, rarely takes place to any dangerous extent, unless it occurs in "bleeders," or such as labour under the hæmorrhagic diathesis. It has always a tendency to stop by itself through the natural hæmostatic processes such as have been described. Should it, however be too persistent, the surface of the wound should be exposed and cleansed, the stimulus of the air being often sufficient to excite closure of the vessels. Moderate pressure upon the surface of the wound or a stream of cold water over it are also valuable adjuvants.

Venous hæmorrhage.

Venous hæmorrhage, unless from the trunks of large veins, usually quickly ceases from the collapse of the veins. Where any impediment, however, exists to the return of blood from the wounded part it may prove troublesome, but its arrest will probably be secured on the removal of the obstruction. The elevation of the wounded part will tend much towards this end, as will also the application of cold or firm pressure upon the spot.

Division of large veins.

When large veins are divided and the bleeding is copious, they must be tied or twisted. A small opening into a large trunk may be closed with a fine ligature, leaving the main canal free, for wounds of veins heal rapidly, as after venesection.

Injuries, however, of the large venous trunks are of grave importance, and any wound or injury that induces, directly or indirectly, the complete arrest of the venous circulation through one of these, is probably of greater consequence than a wound of an artery. The internal jugular vein may, however, be tied with success.

A vein is known to be opened when black blood flows from the wound in a steady stream, and from its distal part, when pressure above the wound increases the flow, and pressure below retards or stops it.

Phlebitis.

Phlebitis is the chief fear a Surgeon entertains from an injury to a vein, and when it occurs it is very fatal. Veins will, however, doubtless, bear much more manipulation than our forefathers believed, without any such dangerous result ensuing.

Air in veins.

The entrance of air into a wounded vein is likewise a source of great danger; but to this subject attention will be drawn in a future chapter.

On the general treatment of hæmorrhage.

Syncope.

The general treatment of hæmorrhage is of importance, although subsidiary to the local. When *syncope* takes place as a result of loss of blood, the Surgeon should not be too hasty in attempting to overcome it, for it is without doubt one of the most valuable means that Nature employs to check bleeding and to assist natural hæmostatics; at the same time great care is needed that the syncope be not a fatal one. Should such an event appear probable, the patient should be kept in the horizontal posture with the head low; cool air should be allowed to blow upon the face, or cold water sprinkled over it; some diffusible stimulant, such as ammonia, ether, chloroform, or the nitrite of amyl, may be inhaled, or brandy given in small quantities. In extreme cases some Surgeons advise pressure being made upon the abdominal aorta or large arteries, to confine the blood to the nerve-centres; or even transfusion may be employed. This operation, however, has never been in high favour with Surgeons; from accoucheurs it has received good support, Dr. Blundell having given it his energetic advocacy. When tried it should not be put off until too late a period, when the hope of rousing the nervous and circulating systems has become almost forlorn. Under all circumstances plenty of bland liquid nourishment should be given, such as milk, eggs, broths, &c., and stimulants in moderation. When there is a prospect of a recurring hæmorrhage all food should be given cold, and sufficient stimulants to excite the failing heart to action. In the convalescing stage iron and quinine, ammonia and bark, are of the greatest value. Opium is a drug that must not be forgotten, for in the restless stage of bloodlessness its action is most beneficial; it must, however, be given with caution, for with a feeble heart large doses are apt to depress. Half-grain doses repeated at intervals are probably the safest; larger doses may, however, at times be given. When capillary bleeding takes place to any extent after an operation, a full dose of opium, say a grain, is often most valuable.

When the hæmorrhagic diathesis exists, iron in full doses is of great service, the tincture of the acetate or perchloride in half-drachm doses being the best. Oil of turpentine is likewise a remedy of value; twenty minim doses may be given to an adult; gallic acid in ten-grain doses, and acetate of lead in one-grain doses, are also of use—all these drugs acting upon the blood and disposing it to coagulate.

Transfusion.

Transfusion.

When Dr. Lower, of Oxford, with Sir E. King, in 1665, first practised transfusion, blood was drawn from an artery and conducted *directly* by means of a tube into the vein of the patient, the blood being propelled simply by the force of the circulation of the emitter. As time progressed the inexpediency of opening an artery was felt, and the plan of transmitting blood from vein to vein came into use, and in 1785 was warmly advocated by Dr. Harwood, of Cambridge. With this change of practice the mode of operating had to be altered, for the force of the venous circulation was found to be insufficient to propel the blood. The *indirect* or *mediate* mode of operating consequently came into use, the blood of the emitter being received into a vessel and transmitted by a tube or syringe into the vein of the patient. To Blundell is undoubtedly due the credit of having devised an apparatus by which the operation can be efficiently performed. He called it first an "impeller," and when improved a "gravitater" ('Lancet,' 1829). Since his time Drs. Aveling, Hewitt,[1] and Braxton Hicks[2] have done much towards rendering the practice more safe and certain. The object of the Surgeon in the operation is to transfuse blood from a healthy man into a bloodless one, and his aim is to prevent the coagulation of the healthy blood during the operation, and to guard against the introduction of air into the veins. To do this without a special apparatus, the vein of the patient is to be exposed and longitudinally opened sufficiently to allow the introduction of a fine tube—a pad of lint and a bandage being applied to the vein below the opening to prevent hæmorrhage.

The blood to be injected is received into a warm vessel, and taken up into a three- or four-ounce glass syringe, *well warmed*, and then injected slowly into the vein. The Surgeon takes care to expel all air from the syringe before he introduces the nozzle into the cannla by holding it point upwards, and pressing the piston till blood escapes, and not being so dilatory as to allow of the coagulation of the blood. Dr. Hicks has suggested the admixture of a solution of the phosphate of soda (one ounce of the phosphate to a pint of water at blood heat) with the blood, in the proportion of one part of the solution to three of blood, to prevent fibrillation. Should Blundell's, Hewitt's, Hamilton's, or Hicks' apparatus be at hand, it should be preferred to a simple syringe. Some ten ounces of blood may be transfused, but four or five are often enough; indeed, the smaller the quantity the better.

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[1] 'Obstet. Trans.,' 1865.

[2] 'Guy's Rep.,' 1868.

The operation has not hitherto been a very successful one.

Summary of the treatment of hæmorrhage from wounded vessels.

By way of summary, the following conclusions may be drawn up *for the treatment of hæmorrhage from wounded vessels.*

All arteries, whether divided or wounded, from which blood flows, are, if possible, to be twisted or tied at the seat of injury; and to do this, when room is required, the wound may be enlarged. *Both ends of a divided* artery are to be dealt with separately, and a wounded artery is to be twisted or tied above and below the wound.

When no bleeding is present, no operation is required as a rule; although, in exceptional cases, this may be deviated from, as when a renewal of the hæmorrhage will endanger life.

When *moderate* arterial hæmorrhage exists, and the artery cannot be taken up in the wound without an operation, the graduated compress may be employed with a good chance of success; should it fail, the vessel must be secured.

When arterial hæmorrhage endangers life, and the artery cannot be treated at the wound, the trunk of the vessel is to be secured above the wound.

When *recurring* hæmorrhage is severe, the wound is to be reopened or enlarged, all clots are to be turned out, and the vessel tied or twisted; when moderate, it is to be treated by elevating the part, by pressure over the main trunk of the vessel, or the wound, and by the application of cold, as the ice-bag.

At times all bleeding ceases on the mere exposure of the open wound; at others there is a general oozing. Under these circumstances, if exposure of the wound to the air, or to a stream of cold water, fails to check it, well-applied pressure over the wound will often suffice. In exceptional cases styptics may be required.

Treatment of secondary hæmorrhage.

Secondary hæmorrhages are to be dealt with in the wound as primary; that is, when bleeding is profuse, the artery is to be re-ligatured or twisted at the bleeding point; when not severe, it will probably be restrained by pressure and the elevation of the part; for in a general way, when secondary hæmorrhage takes place after the application of a ligature to a wounded artery, the bleeding comes from the lower end of the vessel. Guthrie has fairly shown that repair is less perfect in the lower end of a divided vessel than in the upper; that there is less contraction and retraction of the vessel; less perfect coagulation of blood and effusion of plastic lymph.

Hæmorrhage from wounded veins.

Hæmorrhage from wounds of veins can usually be readily arrested by elevation of the limb and moderate pressure upon the part.

Veins may, however, be ligatured or twisted with impunity, should the treatment suggested fail to be inapplicable.

DISEASES OF THE ARTERIES.

Arteritis and Atheromatous Disease of the Arteries.

On arteritis and atheroma.

These may be considered together, for there is no question as to there being a close relationship between the two affections. Virchow and Billroth abroad, Wilks and Moxon in this country, have fairly proved that atheroma of an artery is due to a sub-inflammatory process. That this is not the ordinarily accepted opinion is quite true, for in the modern text-books an opposite view is invariably given; the influence of Gulliver's investigations ('Med.-Chir. Trans.,' vol. xxvi) having led all his followers to assert atheroma to be a fatty and calcareous degeneration of the inner, and consecutively of the middle arterial coats, with subsequent thickening of the outer cellular one.

Acute arteritis.

Acute arteritis, as some authors have described it, must be very rare indeed, for many recent pathologists have never met with an instance, and it is more than probable that the claret-colour staining of the inner coat of an artery has been mistaken for inflammatory injection, and a fibrinous plug for inflammatory exudation. It may, however, occur as a local ulcerative arteritis, especially near the heart, in rheumatic subjects. In a drawing in the Guy's Museum (42^{31}), a perforating ulcer in the carotid of this kind is illustrated, in which the opening was plugged, and hæmorrhage was consequently prevented by a coagulum.

Chronic arteritis.

Chronic arteritis is a fairly recognised affection, more particularly as a local one, where it is generally due to some injury, or to the extension of some inflammatory action from a wound or ulcer. In these cases all the coats of the vessel are infiltrated with inflammatory products, purulent or otherwise, and the vessel is filled with a more or less purulent coagulum. This is well seen in the umbilical vessels of the funis after the application of a ligature.

As a general affection chronic arteritis is less common. Wilks ('Guy's Rep.,' 1869), and Savory ('Med.-Chir. Trans.,' 1856), have published examples in which the principal arteries of the body were thickened and obstructed, the vessels being filled with old clot that was "so closely adherent that the wall of the vessel would split rather than part from the clot. At both the ending and commencing parts the clot was white and like fibrous tissue, and could not be distinguished from the coats, which here were swollen and atheromatous. The adherence, indeed, appeared to be here in the clot also as well as in the arterial coat."—Wilks.

Moxon's views of diseases of the coats of arteries.

Such cases as the last are, however, rare compared with those of local chronic arteritis, as met with in the arch of the aorta at its bifurcation and other parts. It is indicated by thickening of the vessel and loss of its elasticity, by the external coat changing into a tough fibrous tissue, and the affected part, instead of feeling thin and pliable, becoming hard and leathery. "Now, such changes as these are commonly present along with the atheromatous pulp in the deep inner coat, and these are the part of the changes that go by the term atheroma as commonly accepted. Changes of a kind that cannot be regarded as other than inflammatory are present in nearly all bad examples of atheroma; the extent of the inflammatory changes generally surpasses that of the atheromatous, and these inflammatory changes occur often without any atheroma, and especially in younger subjects, about or under middle age. The more inflammatory changes tend more to produce aneurisms than do the atheromatous patches. When atheroma is thoroughly established, so that a pulpy mass is formed in the coats at any spot, this is generally thick and hard and unyielding, and does not give way to pressure so as to form an aneurism. The disease that leads to aneurism is the same disease as leads to atheroma, and I think it is a correct way of describing these relations to say that they are alternative results of the disease of the coats. I mean so that if the sub-inflammation is severer, then the coats are softened and yield early, before the thickening and stiffening chronic process that leads to the atheroma patch has time to occur. On the other hand, if the sub-inflammation is lower and slower, then there is not such softening at any time in its course as to lead to aneurismal yielding; but the result is a slow thickening, which reaches a considerable and a sufficient degree before any fatty degeneration occurs within it, and then always the thickening goes further than the granular change, so that the wall of the artery is rather stronger there than weaker; and if the sub-inflammation be yet slower and slower the fatty or granular change in the coat goes on to an accumulation of lime salts or petrifaction of the spot, the stone in the wall showing sometimes some rude bone-cells, so that ossification may be thought really to occur, though the bone is truly a very rough production, if it be bone at all. Now, if instead of being thus slow, so as to give time for the calcareous change of its products, the sub-inflammation be very acute, then the arterial wall may rupture, and either sudden death or a false aneurism be the result." "I might," adds Moxon, "give practically any number of cases and drawings, showing the active cell formation in cases of atheroma, this cell formation found in the deep layer of the inner coat especially, and causing the production of little nests of cells, in which fat and lime soon accumulate. In severer cases the middle and outer coats, and the deep layer of the inner coat, are seen to be charged with lymph-cells in enormous numbers, crowded together, and separating the proper elastic and the muscular fibres into little patches and shreds, while both elastic and muscular fibres fall into a state of fatty degeneration."—Moxon, 'Guy's Hosp. Rep.,' 1870-71.

Active cell formation in atheroma.

In Figs. 108 and 109 these changes are to be seen; they are taken from drawings kindly made for me by Dr. Moxon. His description is appended.

Dr. Moxon believes, and I think rightly, that mechanical strain is the main cause of atheroma of the arteries. It is mostly found in arteries at points where the strain upon the coats is greatest, and in men who follow laborious occupations. Gulliver originally described it as a disease of the larger arteries, but it is now known to involve even the minutest capillary—arterial or venous.

Microscopical appearances of atheroma.

In its earliest stage it appears as a small white elevated deposit on the inner membrane of the artery—this deposit being made up of fat-globules, with plates of cholesterine, and amorphous calcareous matter, soluble in hydrochloric acid. In advanced disease calcareous plates are found in the larger arteries, and the smaller are converted into completely solid tubes. The vessels, moreover, alter in shape, they become tuberous and tortuous—dilatation taking place at the points of bifurcation. When the disease is very extensive or advanced, the inner coats become destroyed and undermined with blood. When this takes place to any extent, what is known as a *dissecting aneurism* may be produced; in other cases the inner coat is so raised by the clot of blood behind it, that the arterial canal becomes closed, and gangrene of the parts supplied by the occluded vessel may take place. In a preparation in the Guy's Museum (1465), the aorta was thus affected, causing gangrene of the extremities. In other cases the vessel may rupture, and cause death by hæmorrhage. In rarer cases the vessel may be completely closed by the calcareous disease, in some the roughened raised patches become the centres of fibrinous adhesions, which may either cause occlusion of the vessel directly by their size, or indirectly by being

Formation of dissecting aneurism.

Fig. 108.

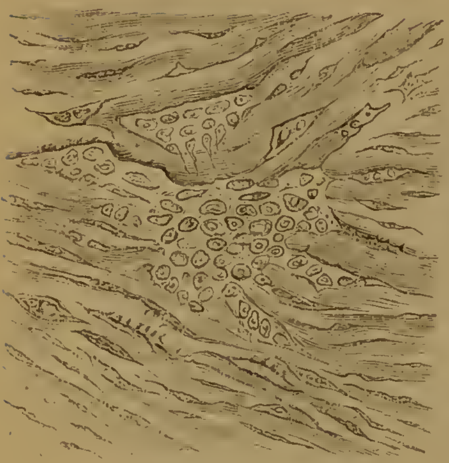


Fig. 109.

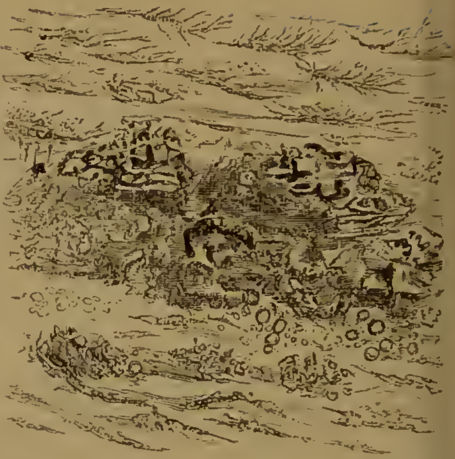


Fig. 108 shows the incipient inflammatory stage of the change in an artery which leads to atheroma, and in which aneurism usually occurs.

Fig. 109 shows the final degenerative stage of the same change in the artery which constitutes atheroma.

Fig. 108 is a small portion of a fine section of an artery from the neighbourhood of an aneurism; the artery was here soft and swollen, and had a more pellucid and bluish appearance than natural. A small and early patch of the disease is represented. The cells of the artery-wall are found enlarged, their nuclei multiplied, and at the centre of the patch they burst towards each other to make a cluster of cells derived from the multiplied nuclei.

Fig. 109 is taken from the same artery at another spot, when the coat had the well-known yellow appearance of atheroma. Here the patch of multiplied cells has degenerated to a heap of oily and earthy matter with some plates of cholesterine. The individual cells around are seen to be degenerated in the same way. Some of those at the upper part of the figure are, on the other hand, developing into elastic fibrils. This is a frequent accompaniment of the atheromatous process, and its effect is to ultimately strengthen the arterial wall at the diseased spot.

Atheroma often a cause of gangrene.

carried into more distant arteries, as emboli. In both cases gangrene of the parts thus deprived of blood will be produced. *Senile gangrene* is doubtless occasionally caused in this way. It is thus seen that this atheromatous disease of the arteries is often the cause of gangrene of a part by direct occlusion of the vessel as well as by embolism. As a general rule, however, in those instances in which portions of artery are found to be withered and converted into fibrous cords, evidence is wanting of arteritis being the cause; indeed, recent investigations tend to show that such changes are the natural result of an obstruction of the vessel, and that this obstruction is probably due to a plugging of the canal by a clot, or what is now known as an embolus.

Embolism,

On embolism.

or the occlusion of a vessel, large or small, by a plug of fibrin or calcareous matter, carried by the blood from some distant part, and generally from the heart, is a somewhat common affection. The physician meets with it in cases of paralysis more or less complete, from the plugging of a cerebral vessel, associated with valvular heart disease, Examples of the arterial form.

so-called acute rheumatism, or atheromatous arterial disease. The Surgeon meets with it in certain forms of amaurosis and local gangrene; the pathologist sees it in the fibrinous clots found frequently in the liver, spleen, kidneys, or other organs, for any may be involved. Any artery may be occluded, even the abdominal aorta.

Symptoms of arterial embolism.

The symptoms of embolic occlusion of an artery are sudden and severe pain in the part from which the circulation is cut off, with numbness and tenderness in the course of the vessel; the pain will at times extend down the whole course of the artery, at others it will be local. Symptoms of a deficient circulation in the part soon appear, such as coldness, and pallor of the skin, and these may go on to complete gangrene. All cases of embolic occlusion of an artery do not, however, end in death of the part, for in patients of good power the collateral circulation may become subsequently established and a recovery take place. It is in patients of feeble power that gangrene is generally seen; indeed, it is in such that embolic arterial occlusion is mostly found.

Example.

These points were well illustrated by the following case:—A woman, æt. 47, who had never had any illness, was seized in June, 1868, with a mild attack of hemiplegia on the left side, from which she perfectly recovered in three weeks. She remained well, and returned to her ordinary duties, those of a laundress, till September 27th, 1868, when, whilst kneeling, she suddenly felt a severe pain in the *right* leg, extending down the calf. This was rapidly followed by numbness and coldness of the leg, and discoloration. She was admitted into Guy's under my care, three days subsequently, with gangrene of the foot and lower two thirds of the leg. The pulsation in the femoral artery was normal, but no vessel could be felt below the thigh. I amputated the limb at the knee-joint on October 13th, twisting the popliteal and other arteries. Some sloughing of the stump followed, but good success appeared probable, when acute bronchitis set in, followed by delirium and death. Dr. Fagge kindly examined this patient's heart before the operation, and reported, "There is scarcely any evidence of cardiac disease, but I think that I discover a short presystolic bruit. If this is so, the mitral orifice is probably contracted, and a clot formed on the valve, or in one of the heart's cavities, may have been carried into the artery of the lower limb." After death the mitral was found the size of a button-hole. Around its edge were recent vegetations; one of them had doubtless been carried into the circulation and caused the gangrene, as another had previously caused the paralysis three months before.

Many cases of senile gangrene are doubtless embolic, from the washing away of some calcareous fragment in an atheromatous vessel.

Hyperæsthesia of parts below occlusion by embolus.

In some cases of occlusion of an artery by an embolus, as after the application of a ligature, hyperæsthesia and increased temperature of the part below the seat of obstruction may be met with. These symptoms are clearly due to the influence of the nervous system and the congestion of the smaller collateral vessels.

Of the venous form.

All these cases are examples of embolism involving the arterial system; but it is to be remembered that when the embolus is carried from the right side of the heart, the pulmonary artery in some of its branches may be closed—giving rise to lobular pneumonia, as seen in pyæmia, or in gangrene of the lung. Sir J. Simpson has shown this to be the cause in some cases of sudden death in puerperal women; it is also met with after fevers and thrombosis of veins; it may likewise occur after an operation on veins.

Wilks on venous and arterial pyæmia.

Dr. Wilks has also fairly shown ('Guy's Hosp. Rep.,' 1870) that, as in phlebitis, morbid matters may be taken up by a vein and carried into the circulation, through the right side of the heart, giving rise to *venous pyæmia*, so disintegrated fibrin of the blood may be carried into the arterial system from the left side of the heart, and give rise to *arterial pyæmia*. Febrile symptoms with joint pains and rigors, associated with aortic or mitral bruit, ought to excite suspicion of this latter affection; and when the liver or spleen is found enlarged, the diagnosis is confirmed. He points out, also, how this occurs as a secondary fever of the nature of pyæmia after scarlatina, which is often followed by joint pains, and not infrequently endocarditis; and in confirmation of these views I may mention that it has fallen to my lot, in the case of two female patients, aged fifteen and twenty years, to amputate a leg for gangrene, the result of occluded femoral arteries after scarlet fever, and in neither of these cases had any artery to be secured; in both a good result rapidly ensued.

Treatment.

TREATMENT.—The objects Surgeons should have in view in the treatment of a vessel occluded by an embolus are to favour the venous circulation through the limb by its elevation, and to establish the arterial collateral circulation by maintaining the warmth of the limb by means of cotton wool carefully wrapped round it over oiled lint. Pain is to be relieved by sedatives, such as chloral or opium given by the mouth, or morphia injected subcutaneously, and the powers of the patient are to be maintained by nutritious diet, by stimulants carefully administered, and by tonics.

When gangrene has resulted.

When gangrene has taken place, the parts may be covered with some antiseptic material, as carbolic acid, in a watery or oily solution, one part to thirty, or with powdered charcoal, chloralum, or MacDougal's disinfecting powder; and, if the odour is not very offensive, simple oakum surrounding the part may be enough.

When the line of demarcation has formed, and the gangrenous part can be removed by amputation, such an operation may be performed, but the Surgeon should always be cautious in interfering in these cases. He should at the same time take care that operative interference is not postponed too long.

ANEURISM.

Definition.

An aneurism is a *sacculated tumour* communicating with the canal of an artery, and formed from its walls. When all the coats are involved in the sacculated dilatation it has been the fashion to describe it as being *true;* when the two inner coats have given way and the external or cellular alone remains, as *false;* but I agree with Holmes, that it is impossible clinically to perceive any difference between true and false aneurisms at the time they generally come under observation; the true become false as they grow, and the false are far the more common. I hold, moreover, with Moxon, that pathologically, "when an aneurism has reached any size, and often before it has well started, the several coats of the vessel have lost by inflammation their distinctive character, and that the sooner the division of aneurisms into varieties by

Varieties.

the supposed behaviour of the several coats becomes purely a matter of history the better.”

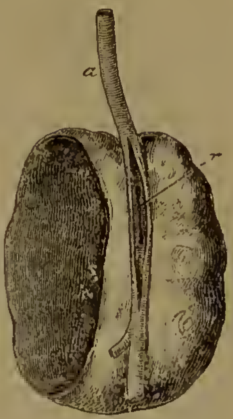
Fusiform.

When the distension of the vessel involves its whole calibre, a *fusiform or tubular aneurism* or aneurismal dilatation is said to exist, whether the enlargement be or be not due to an inflammatory disease of the arterial coats.

Diffused.

What is described as a *diffused, spurious, or consecutive* aneurism is where the sac of the aneurism is not formed by any of the arterial coats, but by the muscles and condensed cellular tissue of the part into which the extravasated blood has been effused from a ruptured aneurism or a ruptured artery; although these terms should not be applied to cases in which there is *diffused extravasation* of blood.

FIG. 110.

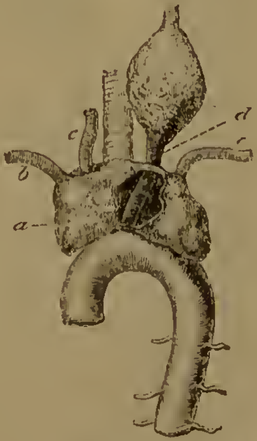


Sacculated traumatic aneurism. Drawing 44^{16}, Guy's Hosp. Mus. Mr. Poland's case.

Dissecting.

A dissecting aneurism is one in which the inner coat is separated from the middle, or where blood is extravasated into the thickness of the middle coat itself, or between the middle and external coats, the blood re-entering the cavity of the artery at some distant spot. The aorta is the part usually affected, and even its whole length may be involved. An excellent example of this affection has been recorded by Dr. Fagge (‘Med.-Chir. Trans.,’ vol. lii). These cases, however, rarely come into the hands of the Surgeon. To show what an aneurism may do, the following figure (Fig. 111) has been given. It was taken from a drawing in the Guy's Hospital Museum. The aneurism of the innominata has involved the left carotid and root of the subclavian, a second aneurism of the left carotid existing above.

FIG. 111.



Drawing 42^{48}, Guy's Hosp. Mus.

Pathology of aneurism.

Pathology of aneurism.—A low form of inflammation of the arterial walls is without doubt the most prolific, and over-action of the heart and circulation, the exciting cause of aneurism: direct injury to an artery is an occasional cause (traumatic), although more frequently the injury sets up the disease in the artery that produces the aneurism. Whenever the coats of an artery are weakened by accident, disease—suppurative or otherwise—or the loss of their natural support, they become prone to dilate under any sudden or prolonged increase in the force of the circulation, under violent exertion, or a sudden emotion of the mind. Dr. Rendle, of the Queen's Prison, Brixton, has recorded two cases in which abdominal aneurism could be traced to the shock caused by a sentence of transportation. Thus aneurisms are most common in the aorta, where chronic inflammatory changes are so prone to appear, and the heart's action is the more directly felt; at the bifurcation of an artery, where the force of the circulation is always more powerful; or at the flexure of joints, where muscular action is the most liable to tell by overstretching or bending.

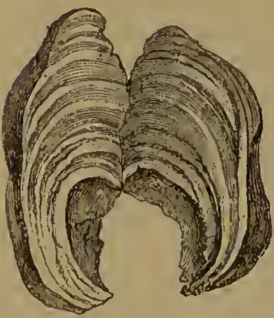
That it is a disease of the arterial system and not always traumatic is proved by the fact that a man may have an aneurism form when in bed, and that the whole arterial system may be involved in the disease. Broca has mentioned a case of Pelletan's, in which sixty-three aneurisms were found in one body. Aneurism is also a disease of middle age, half the cases, according to Lisfranc, occurring between the ages of thirty and forty-five, rare cases being on record in which it was found in children. Syme has reported a case in a child aged nine.

Progress of aneurism.

Spontaneous cure.

Appearances of a cured aneurism.

FIG. 112.



Laminated coagulum removed from axillary aneurism twelve years after Mr. Key had ligatured the subclavian artery. Prep. Guy's Hosp. Mus., 1499^{64}.

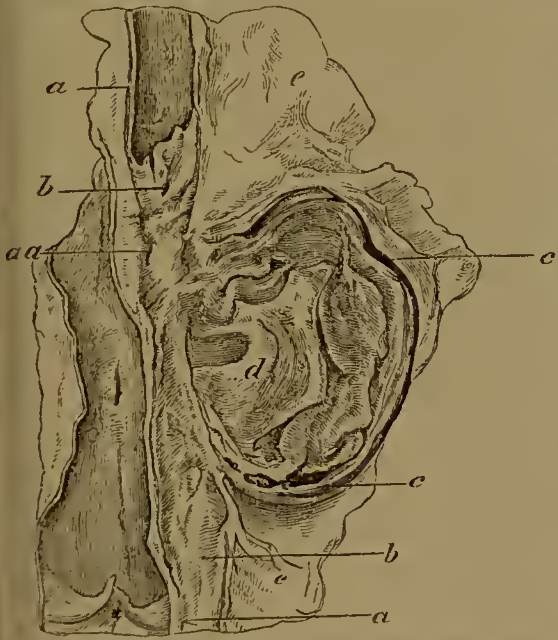
An aneurism when once formed has a natural tendency to increase, the sacculated more so than the fusiform, and the sacculated aneurism communicating by a small opening with the cavity of an artery, as a rule, runs its course more rapidly than another in which the opening is free. The force of the circulation is more concentrated upon one point of the aneurismal sac when directed through a small orifice than through a large one, and more when directed through an orifice than when diffused over an expanded artery. Hence sacculated aneurisms attain a much larger size than the fusiform, and are far more liable to rupture. On the other hand, the sacculated aneurism is more capable of a natural cure than the fusiform, the cavity of the former probably undergoing a partial and possibly a complete closure by the coagulation of the blood; whilst it is a rare thing indeed for a fusiform aneurism to undergo any such natural recovery, that is, when produced by a simple dilatation of all the coats. When the coats are diseased the fusiform is as prone to increase as the sacculated, and as capable of a spontaneous cure. In all cases, therefore, of sacculated aneurism, and in some of fusiform, a *spontaneous cure* may take place, and this is realised by the filling of the sac with coagulated blood and its subsequent consolidation. When this process is slow the fibrin of the blood is deposited in layers or laminæ (Fig. 112); the external layer in contact with the walls of the sac becomes united with it, and so strengthens it as to prevent its dilatation; it becomes dense by contraction and decolorised. Subsequent layers form in the same way as the process of recovery goes on, until the whole sac becomes filled and finally obliterated. A section of an aneurismal sac thus cured resembles much that of an onion, the outer laminæ of fibrin being thin, fibrous, firm and bloodless, each successive layer towards the centre approaching more the colour and consistency of newly coagulated blood; the laminated coagulum lining the sac is frequently called after Broca "active clot," and the soft coagulum in the centre "passive clot," from the idea that this latter is a mere post-mortem deposit and not a vital one; but this view can hardly be correct, as there can be little doubt that in all cases of aneurism that are rapidly cured by pressure, digital or otherwise, the consoli-

Consolidatio due to coagulation of blood in sac.

dation of the sac must be due to the simple coagulation of the blood in the sac, and its subsequent induration and contraction; for a few hours are clearly too short a time for the laminated coagulum to form in any other way. In the following beautiful drawing (Fig. 113) by Dr. Moxon, taken from a specimen of popliteal aneurism, which was cured in a man under my care two years before by digital compression applied for four and a half hours (*vide* 'Guy's Hosp. Rep.,' 1869), the whole pathology of aneurism is shown.

Fig. 113.

Section through an aneurism of the popliteal artery, cured nearly two years before by digital pressure. The aneurism is not dissected out, but left embedded in the popliteal fat, *e*, *e*.



a. The section edge of the arterial coats where healthy.

a, *a*. The coats in the diseased and occluded part of the artery. Their substance is dispersed and blended with the new fibrous tissue *b*, *b*, which fills the vessel, yet not so much diffused but that they can still be traced to the mouth of the aneurism (opposite the upper *c*).

c, *c*. The aneurism sac, composed of laminated clot and compressed tissue welded together indefinitely.

d. Scarcely laminated clot, filling the hollow of the sac.

The vein, with two valves in its lower part, is seen close behind the artery.

Colles, of Dublin, with some older pathologists, used to think that the fibrin that lines the sac was the product of an exudation from the lining membrane of the sac, and that successive exudation of this material formed the laminæ. This view, however, is now nearly exploded. Le Fort also accounts for the cure of the fusiform aneurism by inflammation of the inner lining of the sac, looking upon the fusiform as a simple dilatation, which it is not in all cases. Most pathologists, however, now admit, that where the inner tunic of an artery exists in a healthy state in an aneurism, the coagulation of the blood within the sac does not take place, and that consequently a spontaneous cure is impossible; that in the sacculated or fusiform aneurism successive deposits of fibrinous laminæ only take place, when the internal membrane is absent, from the contact of the blood with the walls of the sac.

Mr. Poland has recorded a case, probably unique, occurring in the practice of Dr. Adams, of Dublin, of fusiform aneurism of the subclavian, which tends to support this view. ('Med.-Chir. Trans.,' vol. lii, 1869.)

Cure of aneurism by distal occlusion.

An aneurism may likewise be cured by the distal occlusion or plugging of the artery beyond the sac with a clot that has been dislodged by the force of the circulation, accident, or design. The vessel may be at first only partially closed by the clot, but fresh fibrin will soon be deposited upon the "embolic plug" and complete obstruction be produced. This natural mode of cure is utilised in the distal operation for the cure of aneurism as in the cure by manipulation.

Cure by sloughing of sac.

Pressure of sac on artery.

Recovery may also be caused by the sloughing of the tumour (suggesting the treatment by caustics); it is likewise on record that the artery with which the aneurism is connected may be obstructed either above or below the sac by the pressure of the aneurism itself; either from its being bound down by a strong fascia, or from the pressure caused by effused blood following its rupture; and in the treatment by flexion this natural mode of cure is made use of.

Mode of extension of an aneurism.

As an aneurism increases, and encroaches on the neighbouring parts, tissues are separated and even absorbed; bone may even be gradually worn away by the steady pressure of the pulsating tumour, so that in thoracic aneurism the sternum may be perforated, or the bodies of the vertebræ eaten away and the spinal canal opened (Prep. 1489^{30}, Guy's Hosp. Mus.). During this increase also the tissues surrounding the sac may inflame, rarely, however, suppurating, and by becoming condensed give the aneurism some support and tend to retard its growth. In rare cases, however, this inflammatory action may involve the sac itself and cause sloughing; when the aneurism increases unchecked it will eventually give way.

Termination of aneurism.

A thoracic or abdominal aneurism may burst into a mucous tract such as the trachea, pharynx, œsophagus or intestine, and, when it does, Dr. Gairdner ('Med.-Chir. Trans.,' vol. xlii) has shown that it proves fatal by a recurrent hæmorrhage through a *small* orifice; when it bursts into a serous cavity such as the pleura, pericardium or peritoneum, it destroys by a sudden hæmorrhage through a *large* aperture. Cases are also on record where it discharged itself into a vein or the pulmonary artery. External or surgical aneurisms burst by the formation and giving way of a slough. Aneurism of the extremities in surgical aneurism may give way into a joint or cellular tissue; in rare instances an aneurism may burst externally.

On external aneurism.

The Surgeon has, however, more to do with external than internal aneurisms, and although the pathology of both forms is alike, the treatment differs. It is, therefore, to surgical aneurisms that the following remarks will particularly apply, and first of all as to their symptoms and diagnosis.

Symptoms.

Diagnosis.

Symptoms.—An aneurism has no pathognomonic symptoms, and its early symptoms are very uncertain; it often happens that the first one to which the patient's attention is directed is some *swelling*, although it may be that *local throbbing* preceded the discovery of the disease—some weakness or stiffness of an extremity—or some *nerve pain*; but such symptoms are not constant.

Pain.

When, however, the Surgeon is consulted for pain that shoots down the course of a nerve running in contact with a large artery, he should allow the thought of aneurismal pressure to pass through his mind, and when this is associated with the presence of a tumour connected with the vessel the suspicion of its being aneurismal should be excited. Should this tumour be *soft* and

Pulsating tumour.

pulsating, should it become tense on the application of pressure to the trunk of the artery on the distal side, and flaccid, non-pulsatile, and vanishing on pressure by the arrest of the circulation on the cardiac side, and should pressure on the tumour modify the pulse in the vessel below, the chances of its being aneurismal almost amount to certainty.

Expansion of tumour.

Should it expand again readily on the removal of the pressure; should this expansion be accompanied with a peculiar thrill on the re-admission of blood into the sac, and with a bellows murmur or aneurismal bruit synchronous with the pulse on the application of the ear, the diagnosis is complete.

Bruit.

State of pulse on affected side.

The pulse of the extremity below the swelling is generally affected; it becomes weaker and slower than its fellow, and as the disease progresses it may cease altogether. The blood will then flow in a "venous stream" or cease to flow, either from the obstruction of the arterial trunk by the pressure of the aneurism, or the embolic occlusion of the vessel below from a dislodged coagulum. Under these circumstances fulness of the veins with œdema of the parts supplied by the artery will soon appear, and at times excruciating pain from stretching of the nerves will arise. Should the aneurism be cervical and the circulation through the brain be interfered with, giddiness and loss of consciousness may be present, and where any pressure is made upon the recurrent laryngeal nerve a peculiar and characteristic hoarseness will be produced.

Pressure on nerves, &c.

This hoarseness is sometimes associated with loss of voice and laryngeal spasm simulating laryngeal disease; and in the case of a woman æt. 22, under my care, in whom an aneurism existed involving the aorta below the opening of the left subclavian, and pressing upon the left bronchus and trachea, this symptom was so severe as to call for tracheotomy. When the cervical sympathetic ganglia are pressed upon, the pupil of the affected side may be permanently contracted, and nerve pains will be present according to the amount of pressure that is produced.

Difficulties attending diagnosis.

When an aneurism has partially consolidated, or has so enlarged, or become so diffused as to press upon the soft parts and no longer exhibit any pulsation, when it feels firm, with possibly a soft point here and there, some difficulty may be felt in forming a diagnosis, and the Surgeon will then depend as much upon the history of the case as upon the existing symptoms, and when the clinical history of the case is deficient or not reliable the mistake in diagnosis is rendered more probable. When external signs of inflammation or suppuration are present the difficulty will be enhanced, for it must be recorded that aneurisms under these circumstances have been opened for abscesses.

Mistaken for abscess.

I well remember a popliteal aneurism having been so maltreated with a fatal result. Such mistakes of diagnosis ought not, however, to occur; they are due to carelessness; and the diagnosis of an aneurism may generally be made by attending to the history of the case and present symptoms.

Abscess over artery.

An abscess in contact with an artery may receive pulsation from it, as may any cyst or even solid tumour, but in all these cases the pulsation will cease on the application of pressure to the artery above the tumour, without any change whatever taking place in the tumour itself. I have seen a case of lumbar abscess which pulsated freely from aortic contact. It is rare, also, for such tumours to cause a bruit.

Abscess ulcerating into artery.

Rare cases are on record in which an artery in contact with an abscess or suppurating hydatid cyst was opened by ulceration, giving

Pulsatile tumour of bone.

rise to the idea of an aneurism. Pulsatile tumours of bone may also be mistaken for aneurism; but the fact that they are in bone, and more or less ossific, that the bone is expanded, although perhaps irregularly, and that a bruit rarely exists, ought to prevent error. Yet it must be recorded, that men of the greatest skill and experience have mistaken these cases as they have those of the former group.

Treatment of aneurism.

Natural process of cure.

Induce coagulation in sac.

Rest.

TREATMENT.—There is probably no disease the Surgeon has to treat which requires to be dealt with more on scientific principles than aneurism, for all treatment to be effective must be based upon the physiological processes of a natural cure, and the Surgeon will be successful in proportion as he is able to use these processes and turn them to account. Thus it has been explained, that spontaneous cure of an aneurism is commonly caused by the coagulation of the blood in the sac; as a consequence, it ought to be the Surgeon's aim to encourage this in every way, and this end is to be sought by general as well as local means. To induce coagulation of blood in the sac by natural processes, it is necessary to have a feeble circulation through it; for this purpose, *rest in the recumbent position is an essential point of practice*, and it ought to be maintained in every case; indeed, there is reason to believe that by it alone aneurisms have been cured. Luke ('Lond. Med. Gaz.,' May, 1845), Bellingham, Tufnell, and others, have recorded instances of the kind, Tufnell allowing for diet about ten ounces of solid and eight ounces of fluid food in the twenty-four hours; *as a preliminary, therefore, to all other treatment absolute rest is most essential.*

Venesection and Valsalva's treatment.

Acetate of lead.

Diet.

With the same object bleeding has been employed—it was at one time largely practised on the authority of Valsalva, who powerfully advocated it, and probably to excess. There seems no reason why it should not be adopted when the force of the circulation is too strong and the powers of the patient are good; for bleeding under these circumstances is not only rational but scientific; it lowers the force of the circulation, and at the same time has a tendency to render the blood more fibrinous. In internal aneurism it is calculated to be of more use than in external, but practised with caution it is doubtless of value in both. Medicines do not seem to have much influence in encouraging the coagulating process; the acetate of lead gave some promise of value in the hands of my former colleague Dr. G. O. Rees, but more extended experience has not confirmed the hopes raised. In external aneurisms its employment does not seem justifiable to the sacrifice of local means, but in internal ones it may still be used. *Nutritious* but *unstimulating* food should be given in all instances to maintain the powers of the patient, but not to increase the force of the circulation. All mental excitement should be positively forbidden.

Local treatment.

The principles.

The local treatment of aneurism is based on similar principles, the Surgeon's aim being to diminish the circulation through the sac. This may be affected by the following means, viz.—*by compression in one of its forms* of the artery above the aneurism—*indirect*; by *compression of the aneurism itself—direct*; by the *Hunterian operation, i. e.* the application of a ligature to the artery on its cardiac side; by imitating the rare natural process of closing the artery on its distal side, by the application of a ligature, by pressure, or the artificial production of an embolic plug by Fergusson's method of *manipulation;* and last of all, the aneurism may be laid open and both ends tied (Syme's operation), after the ancient method of Antyllus. The treatment by electro-puncture, injection, and the introduction of some foreign body into the sac may be employed in exceptional cases.

Compression.

Indirect compression.

Mode of action.

Digital pressure when practicable.

This plan of treatment to which the term "Dublin Method" may be fairly given, has now found a firm place in surgery; for Todd, Hutton, Bellingham, Tufnell, and Carte, although they did not originate the practice, have adduced ample evidence of its scientific and practical value. It essentially consists in the more or less complete cutting off of the supply of blood from the aneurismal sac by the application of pressure to the artery on its cardiac side; and the more completely the current of the blood is arrested the more rapid appears to be the cure—modern experience fairly proving the soundness of Dr. W. Murray's observation that the principle on which the rapid method rests is clearly "the complete stagnation of a mass of blood in the aneurism until it coagulates." For this purpose digital pressure is undoubtedly the best; when this cannot be made available mechanical means must be employed, and the nearer it approaches to digital pressure the more it is undoubtedly to be preferred. The practice is theoretically sound and practically safe; it is capable by itself of curing the majority of surgical aneurisms—and some internal—and when it fails, in no marked manner militates against the adoption of other means, as the application of a ligature; indeed, if it does not succeed in curing every case in which it is employed it doubtless helps, both by promoting coagulation of the blood in the sac, and by producing enlargement of the collateral vessels. When the rapid treatment is employed the administration of some anæsthetic may be called for, and as its influence is required to be kept up for some hours an additional danger to the treatment is to be taken into account. In other respects the success of the "rapid pressure" treatment has been satisfactory; Holmes recording in his lecture at the College of Surgeons in 1874 that out of twenty-three cases in which it has been carried out fifteen were cured. In the cases, however, in which rapid pressure has been used and failed the application of the ligature has never succeeded. It is applicable only in cases in which the more usual forms of practice are inapplicable or have failed.

When unadvisable.

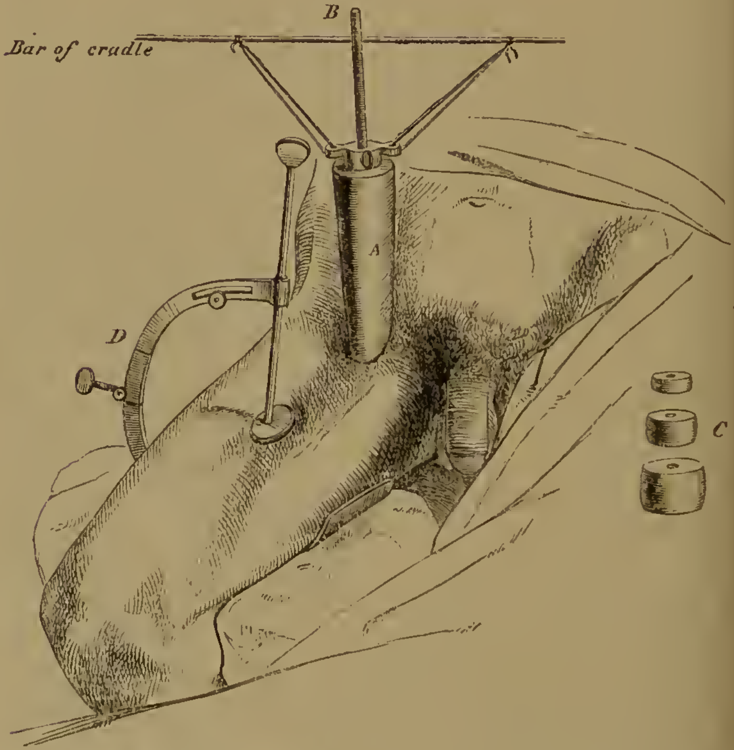
Compression should not be attempted where evidence exists of pressure upon the main vein of the limb, as indicated by œdema; or where the aneurism is rapidly increasing, or a rupture of the aneurism appears imminent; for in such cases a ligature should be applied to the arterial trunk. It should not be persevered with when sloughing of the skin has been induced; and it cannot when from some constitutional irritability, indocility, or stupidity, the patient fails to second the Surgeon's aim; for to make the patient understand the objects the Surgeon has in view is without doubt a valuable means of guaranteeing their successful accomplishment. At least four cases of aneurism of the neck have been cured by digital compression of the common carotid, and M. Rouge, of Lausanne, reports another in which a man æt. 68, had a carotid aneurism cured in seventeen days by lateral pressure between the thumb in front of the sterno-mastoid muscle, and the fingers behind ('Bull. de la Soc. de Chir.,' 1868, p. 464). Mr. Gay has also apparently cured a carotid aneurism by the same means ('Lancet,' Holmes' lect. 1873).

But for digital pressure to be successful it must be well applied; when indifferently carried out it is probably less to be relied upon than

On mode of application of digital pressure.

instrumental pressure. To keep up a steady pressure upon the trunk of any artery for many minutes consecutively is a difficult task; and few men can do it beyond ten; what is wanted is the steady equal pressure of a finger or thumb applied directly over the vessel which is to be compressed; the pressure being so adjusted as to be sufficient to arrest the flow of blood through the artery, but no more. Neither vein nor nerve need be much pressed upon, as a rule, nor much pain produced. Greater pressure than this is a waste of power on the part of the Surgeon, and a cause of needless distress to the patient. To carry out this treatment three good men should be employed for four or five hours consecutively, each in rotation carefully applying pressure for ten minutes at a time. By adopting this practice I have cured an aneurism of the thigh in twenty-four hours, and even less time has

FIG. 114.



Mode of applying pressure to the femoral artery for the cure of aneurism.

Examples.

sufficed in other cases. In a case I recorded in 'Guy's Hosp. Rep.,' for 1869, a patient æt. 32 cured himself of a popliteal aneurism by pressure in four and a half hours; and in a more recent case a man æt. 40 cured himself in eighteen hours, after flexion and prolonged surgical treatment by instrumental pressure had utterly failed. M. Vanzetti in 1855 recorded a case in which digital compression cured a popliteal aneurism in four hours.

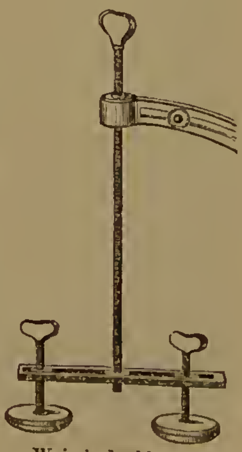
When digital pressure can be employed and is successful it is more rapid than any other, and as a rule less painful. It can also be used where instrumental pressure is inapplicable, as in the case of the carotid. In fact, when admissible, it should always be primarily employed in preference to any other form of treatment. *When digital compression cannot be applied, the next best is instrumental pressure*, and for this purpose there is nothing equal to a conical weight of lead (Fig. 114 A) covered with leather and perforated with an iron axle (B) upon which extra pieces of lead (C) can be dropped (Bellingham's Method); the weights being so adapted as just to arrest the circulation through the artery, but no more. This weight can be slung to a cradle placed over the limb, held by an assistant, or left to the intelligent patient. It can be shifted gently from one spot to another when pressure causes pain, and is far less painful than any other instrument. In popliteal aneurism the weight may be adjusted to the upper part of the groin, and it is a good plan to apply a semicircular tourniquet lower down, by which means pressure can be applied alternately. The instruments of Signorini, Bellingham (Fig. 114 D), Skey, Crampton, or Carte, or any other that allows the pad to press upon the vessel, and not otherwise interfere with the circulation through the limb, may be used for this purpose. All of these consist of a circle or semicircle of steel, a fixed pad being attached on one side for counter-pressure, and a movable pad, adjusted by a screw, for direct pressure. Indeed, with these instruments carefully adjusted by the aid of a trustworthy assistant who will see that pressure is well applied and maintained, and shifted only when required, most cases of aneurism of an extremity may be treated. In Fig. 115 is depicted an ingenious contrivance made by Weiss, on the principle suggested by Mr. F. Bulley, for the application of pressure to an artery by means of pads which may be used alternately, and adapted to Bellingham's instrument (D, Fig. 114) either by the rigid screw or elastic pressure of Coles' pad; and in Fig. 116 a very valuable one as suggested by Mr. George C. Coles—the pressure being elastic—that may be used as hand pressure or adapted to any of the tourniquets. The treatment by compression requires intelligent supervision, and with this is very successful; but without this it is uncertain in its effects.

Instrumental pressure.

Use of weight.

My friend and colleague, Mr. Davies Colley, who happened to have been my dresser when a case of popliteal aneurism was under treatment by digital compression, tells me that he proved by experiment that he could readily arrest the circulation through the femoral artery for six or eight hours at a time with his finger applied directly over the vessel, and the weight adjusted upon his finger, the weight acting in lieu of muscular power that would have been required as the compressing force.

FIG. 115.

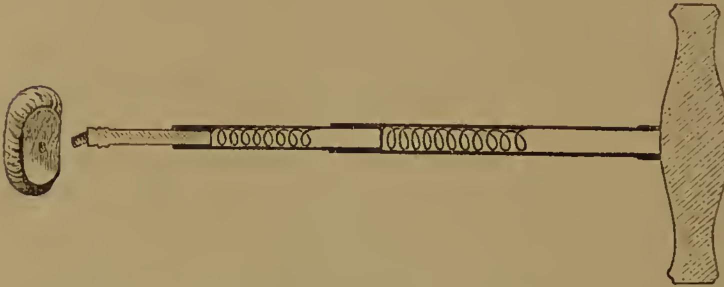


Weiss's double pad.

Points to be attended to in using pressure.

To neutralize the effects of the local irritation of the skin by the pressure, free use may be made of French chalk, starch, or violet powder. To allay pain opiates, or hypnotics as chloral in full doses may be given, and in some cases even chloroform may be used, and its influence kept up for several hours to allow of complete compression being maintained. Dr. Mapother did this for twelve hours. There seems little doubt that, in a general way, complete obstruction to the circulation is more likely to be followed by a rapid cure than is incomplete, and that next to completely stopping the flow of blood till the aneurism has consolidated, the application of the intermittent complete compressing force is to be advocated. That is, complete compression may be maintained for a certain time, and then given up to be returned to as soon as the condition of the patient will permit. The total suppression of the circulation is doubtless the most rapid plan of curing an aneurism; but the partial suppression is likewise successful although slower. But upon all these points I should like the Dublin Surgeons to speak. Dr. Rawdon Macnamara has done so in an able paper ('Brit. Med. Journ.,' Aug. 19, 1871), from which the following extract has been taken. It epitomises the whole:

FIG. 116.



This instrument consists of a trephine handle, to which is attached a straight rod telescopically arranged. The two upper segments of this rod are hollow tubes, each containing a spiral spring; the lower segment is a solid brass rod fitting into the upper, having at its extremity a screw at an obtuse angle. To the end of this a pad, composed of cotton wool and horsehair, is adjusted.

On complete and incomplete obstruction of the artery.

Macnamara on the partial suppression of the circulation.

"A case of popliteal aneurism presents itself for treatment. We determine to use compression. We first carefully ascertain the condition of the patient's general health. If anæmic or hyperæmic, we take appropriate measures; and, when we are satisfied upon this point, we apply some one or other of the most improved compressors—those in which the compressing power is modified elasticity. With this we compress the artery in the upper portion of its course, having previously arranged, some three or four inches lower down, the auxiliary instrument by means of which we propose to alternate the pressure. The upper instrument is now made to control the artery, so as but just to arrest the pulsation in the sac. This is the most delicate step in all the procedure, and is regulated by the hand of an intelligent assistant, who at once informs us when the pulsation is arrested; and then and there the further application of pressure is arrested. A roster of intelligent students is now organized, and to them is entrusted the management of the case. Two are appointed to take charge of the patient for one hour, when they are relieved by two others, and so on during the day, whereby we secure unwearied attention during the period that pressure is kept up; and, as in Dublin we visit our hospital at nine o'clock a.m. the treatment generally commences about that hour, and is continued up to nine o'clock p.m., when all pressure is removed, and the patient is encouraged to take his night's rest undisturbed. Next morning the treatment is resumed, and so on until the cure is perfected. At the commencement of the case, we take the patient into our confidence; explain to him the nature of his case and the method we are about to adopt for his cure, placing clearly before him the alternative, with all its possible dangers, which we should have to adopt in case compression should fail. The value of this procedure is very frequently demonstrated by the intelligent interest exhibited by our patients in the management of their own cases—so intelligent as in protracted cases to supplement, if not altogether to supersede, the supervision of them by our students. In the selection of our compressing force, we adopt in its widest sense the maxim 'Nullius addictus jurare in verba magistri.' Should one compressor prove irksome, we try another; if all should fail, we have recourse to digital compression, or to compression by means of weights; but in every instance, convinced of the soundness of this plan of treatment, we leave no stone unturned to secure it success."

Care during process of cure.

An aneurism is known to be cured when it has consolidated and lost all pulsation, and the anastomosing arterial branches around are visibly pulsating. Care must, however, be observed for some days later, and no movement of the limb or manipulation of the sac be allowed; for in case of rapid cure the clot that has filled the sac must of necessity be soft, and a very little may cause its displacement, and thus interfere with that natural contraction of the fibrin of the blood that is to fill the sac permanently, prevent its dilatation, and cure the disease. At Guy's Hospital out of 17 cases of poplitial aneurism consecutively treated by pressure 11 were cured, and Mr. Holmes told us in his college lectures that out of 124 cases so treated in different hospitals 66 were treated with success, and in 58 without success. Of these latter in 44 the femoral artery was afterwards tied and in 8 amputation was practised, 5 dying. Death occurred in one case; in 4 there is no evidence of subsequent treatment. ('Lancet,' December 19, 1874. In the majority of these cases instrumental pressure was employed, and in some the treatment was imperfectly carried out.

On direct compression.

Flexion of limb.

The treatment of aneurism by *direct compression* next claims attention, and in modern times it is known as that by *flexion;* for there can be little doubt that the *modus operandi* of flexion in the cure of aneurism is mainly due to two conditions; *first*, to direct compression of the aneurismal tumour itself; and *secondly*, to indirect compression of the afferent artery through the medium of the tumour, this indirect compression, either wholly or partially, intercepting the supply of blood to the sac; and *thirdly*, displacement of the clot, as suggested by Holmes, and the consequent obliteration of the mouth of the aneurismal tumour. The mouth of the aneurism may likewise be so situated as to be closed by the bending of the artery; an aneurism in the posterior wall of the popliteal artery being in a far more favorable position for cure than one on the anterior. At the same time we know that forced flexion of a limb is capable of arresting the flow of blood through the healthy artery. In England Mr. E. Hart demonstrated the success of this method of treatment in the year 1858, although in 1857, Dr. Maunoir, of

Geneva, recorded the first successful case in 'L'Echo Médicale' (Neufchatel), and since then many Surgeons have successfully applied the practice. To carry it out, the limb must be carefully bandaged from below upwards to the aneurism, say popliteal, and the knee bent, sufficient force being employed to diminish or arrest the pulsation of the tumour, but no more, some turns of the roller maintaining the limb in this position. The thigh should then be flexed upon the pelvis and the patient turned on his side with the limb resting on a pillow. By this plan the arrest of the circulation through the aneurism may generally be effected, and a good cure may be looked for. When the flexion is forced the patient is too often unable to endure the suffering that the position causes. The plan, however, is so simple, and, when endurable, is so successful, that it should always be attempted where it can be applied, and when unsuccessful it is almost harmless. To large and rapidly growing aneurisms this method is inapplicable, and probably dangerous, as it may induce rupture; and when any inflammation or other complication exists it ought not to be employed; it, moreover, ought not be persisted in when it is not obviously doing good.

Mode of conducting flexion.

Pressure may likewise be used with flexion, where the latter is insufficient, many cases being reported in which success followed the conjoint means. In a case under my care in 1871 I cured an aneurism below the popliteal space in eighteen hours by alternating the flexion of the leg with digital pressure in the groin.

M. Liégois, in an interesting paper (L'Union Méd.,' Aug. 1869),

Fig. 117.

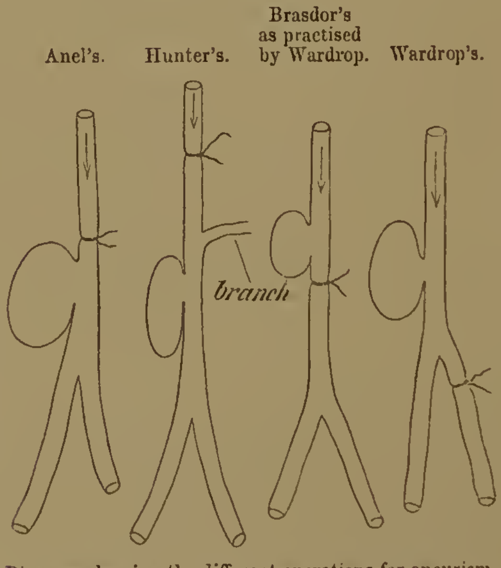


Diagram showing the different operations for aneurism.

gives eleven cases in which flexion alone proved successfully popliteal aneurism, and eleven in which it was successful in combination with other measures. In four it succeeded after other means had failed. On the other hand, it failed in twenty-three cases, or nearly half the whole number, and of these, seven are stated to have suffered rupture and one had inflammation, of the sac. Holmes's statistics show about the same results.

The Treatment by Ligature.

Treatment by ligature.

This plan should only be entertained when that by compression in one of its forms is inapplicable, or has proved unsuccessful. It should be carried out by the Hunterian method (Fig. 117)—by the application of a ligature at some distance from the sac—and not by the "méthode d'Anel," in which the ligature is applied close to the aneurism. By the Hunterian operation the chief flow of blood through the aneurism is arrested, the collateral circulation is maintained, and the artery is more likely to be healthy when ligatured at some distance from the seat of disease. The operation is likewise, as a rule, less difficult.

A moderately thick round ligature should be employed, either of silk or hemp, or Lister's "antiseptic ligature" of catgut steeped in carbolic acid. In a general way the ligature subsequently ulcerates through, or a portion of the artery sloughs away with it, and in this lies the weakness of the treatment by ligature. This process takes from nine to twenty days, or more in large vessels. When the ligature fails, and death ensues, it is from gangrene of the parts below the seat of disease, or from secondary hæmorrhage. The former is the more frequent cause of death, and according to Dr. Norris out of fifty fatal cases of ligature of the femoral artery twenty-three died of gangrene, and only eight of hæmorrhage.

Effects of ligature.

When a ligature is applied to the main artery of a limb the circulation is, for a time, more or less cut off, consequently coldness of the part may ensue, and even gangrene; congestion, however, generally takes place gradually in the extremity, from the blood being forced into the collateral vessels, and with this some increase of temperature may be felt, with hyperæsthesia, a point already noticed in embolic arterial obstruction. Brown-Séquard explains the elevation of temperature that is often observed in a part after the application of a ligature to its main artery, by the paralysis of the vaso-motor nerves that ramify on or in the coats of the vessel; this paralysis producing a corresponding paralysis of the ramifications of the vessels, and as a consequence the blood finds its way freely through the collateral branches into the part below the seat of the ligature; this blood stasis producing both the congestion of the part as well as the concomitant elevation of temperature. ('Archives de Physiologie,' 1851.) The Surgeon should consequently, after the application of a ligature, do what he can to maintain the temperature of the limb, and this is best effected by covering it thickly with cotton wool, at the same time keeping the part raised to encourage the venous circulation. Simple nutritious food should be allowed, but stimulants should be given with great caution, and only enough allowed to help digestion and maintain the force of the heart's action, the habits of the patient forming the best guide as to the quantity. Should pain be present, opium, morphia, or chloral, must be prescribed, either by the mouth or subcutaneously, in doses sufficient to afford relief.

Treatment immediately after ligature.

Subsequent after-treatment.

When the ligature has separated, the wound healed, and the aneurism consolidated, no forcible or prolonged exercise of the limb must be

Gangrene of limb after ligature.

allowed for some weeks, although gentle exercise will be good. The limb also should be kept warm, for it has happened that the circulation through it has failed to become full, or even sufficient after the operation, and that some permanent weakness and loss of sensation has been left. A patient may, however, live a long life after even a double operation; in 1864 I saw a man, æt. 51, upon whom Mr. B. Cooper had operated twenty-three years before (1841) for popliteal aneurism of the left leg, and of the right in 1843; he was an orange porter, and had subsequently followed his work. When gangrene takes place, it is generally as a direct result of the cutting off of arterial supply from a limb, and of the ensuing congestion; as a consequence it occurs within a few days of the operation; it may, however, be produced by the presence of an inflamed or rapidly increasing aneurism, and has then little or nothing to do with the operation. It must be dealt with energetically. Should it be spreading rapidly, and threaten life, amputation of the limb about the line of ligature should be performed without delay. Should it be limited in its nature, and not progressive, the expectant treatment must be employed, the warmth of the limb being carefully looked to, the sloughing or dying parts being covered with well-oiled lint, the venous circulation assisted by the elevated position and by gentle friction, and the powers of the patient being stimulated by food and wine, opiates being given at the same time for the alleviation of pain. The poor success that, as a rule, follows amputation for gangrene coming on under these circumstances, seems to be due too much to a hesitating practice, and to the postponement of operative interference till too late a period.

Suppuration of sac after ligature.

Pulsation in sac after ligature.

When the sac of the aneurism inflames and suppurates after the application of a ligature, the case may be regarded as one of local gangrene, the result of the operation; it is a dangerous complication, and no definite rules can be laid down for its treatment. Hæmorrhage is occasionally a result of this action, the blood coming from the lower end of the vessel; pyæmia or blood-poisoning is another. In a general way amputation is the best practice when it can be performed. In August, 1871, I applied a ligature to the left carotid artery of a man, æt. 29, for a large aneurism, and death ensued on the thirty-fourth day, from suppuration of the sac, nearly the whole aneurism having sloughed. This process had been preceded by some hæmorrhage on the thirteenth day after the operation. The same result may take place after the cure by compression, rapid or slow; indeed, it is an open question whether aneurismal sacs that have been suddenly filled with coagula are not more prone to break up and suppurate than others in which the process has been more gradual. In rare instances the pulsation of an aneurism reappears after the Hunterian operation; and a passing, feeble pulsation in the sac a day or so after the application of the ligature is by no means a rare occurrence; nor need it excite any alarm in the Surgeon's mind; it is doubtless due to the passage of a feeble current of blood through the sac by means of a collateral branch. Should the *pulsation be persistent*, or, indeed, not to be arrested by the ligature to the main trunk, there will be good evidence of a 'vas aberrans' existing by which the blood is brought direct to the aneurism, and which must be ligatured before a cure can be expected. Should its presence be made out by the symptoms just indicated at the time of operation, the vessel must be looked for before the main trunk is tied: indeed, it may be possible that no necessity will be found to tie the main trunk, for the operation for aneurism is to tie the vessel that supplies it quite independent of any name. To do this much surgical skill is called for, and great care. Should it not be possible to apply a ligature to the supplying vessel, other means may be employed, such as compression, or flexion, but in all probability these have been previously tried and have failed, and under such circumstances a second ligature may have to be put on near the sac; or the original operation for aneurism—that of Autyllus, or more recently of Syme—may be required, that is the laying open of the sac of the aneurism, and the application of a ligature above and below the aperture into the artery. To do this much boldness and operative skill are needed to prevent a fatal hæmorrhage. With this object in a case of axillary aneurism, Mr. Syme made an incision above the clavicle along the border of the sterno-mastoid muscle to enable an assistant to compress the subclavian artery against the first rib; acting upon the same principle as he adopted thirty years before when he made an incision behind the angle of the jaw to enable an assistant to compress the internal maxillary artery before the removal of the upper jaw. In 1861 he laid open a gluteal aneurism, having previously thrust a bistoury into the tumour over the situation of the gluteal artery and introduced a finger so as to prevent the blood from flowing except by occasional gushes. He eventually thrust his hand into the sac, rapidly turned out the clot, and had the bleeding orifice instantly under subjection by the pressure of the hand. Both these cases did well. Still this practice is only applicable to desperate cases where all other modes of treatment have failed, or are inapplicable. I successfully employed it, some years ago, in a case of aneurism of the radial artery; and again in October, 1871, in a case of traumatic aneurism of the radial, where the vessel was punctured, about the middle of the arm. In the latter case I divided the vessel completely and twisted both ends, a rapid recovery following.

Operations of Autyllus and Syme.

'Med.-Chir. Trans.,' vol. xliii.

Brasdor's or distal operation.

When a ligature cannot be applied to the cardiac side of an aneurism, and the treatment by compression, &c., has failed or is inapplicable, Brasdor's or the distal operation may be entertained, that is, the application of a ligature to the vessel as it leaves the aneurism (Fig. 117). It is not, however, an operation that can be recommended with any confidence, except for carotid aneurism, in which Wardrop performed it in several cases with success. In aneurism of the innominate artery it is also, open to the Surgeon to ligature the carotid and subclavian arteries consecutively or simultaneously, Mr. Fearn's case and others rendering the operation justifiable. In August, 1871, I performed Wardrop's operation on a man æt. 33 for innominate aneurism. I ligatured the subclavian with a carbolized catgut ligature and closed the wound, sealing it with lint saturated with the compound tincture of benzoin; a good recovery from the operation ensued, and considerable consolidation of the aneurism. The man left the hospital thirty-six days after the operation so well satisfied with the success of the case that he failed to return to have the carotid ligatured; indeed, he went on so well up to about six weeks before his death that he thought nothing of his trouble. He died from dyspnœa, the result of pressure, in August, 1874, three years after the operation. After death the aneurism was found to be full of solid clot; there was a passage through it to the carotid, with a

Case of Wardrop's operation.

smooth lining. Unfortunately the gentleman who took the preparation out threw away the bulk of the clot that filled the sac, which was as big as a fist. The success which followed the operation was, however, most encouraging.

The Treatment by Manipulation.

Fergusson's method by manipulation.

'Med.-Chir. Trans.,' vol. xl.

This method also requires notice, for it has been introduced by no less a man than Sir W. Fergusson. It is based on natural although exceptional processes—the embolic occlusion of the distal end of an artery by a dislodged clot—or it may be employed "to alter the relations of the laminated fibrine in the cavity of the aneurism, so as to bring about a further deposition of fibrine on the projecting surfaces of the displaced laminæ" (Oliver Pemberton's 'Address on Surgery,' Brit. Med. Assoc.). In two cases Sir W. Fergusson endeavoured by manipulating the sac to dislodge the clot, and thus give it a chance of being carried by the circulation into the efferent vessel; and in both the success was sufficient to sanction the repetition of the means in appropriate cases when all other treatment is out of question. In 1872 Mr. Herbert Page, of Carlisle, successfully treated a case of popliteal aneurism by these means. In cervical aneurism the dangers of embolism of the cerebral arteries must be borne in mind; yet at the same time it must be remembered that the Hunterian operation for subclavian aneurism has never been successful, and all other means are nearly out of court. Amputation has, however, been performed under these circumstances with success.

Galvano-puncture.

Garvano-puncture.

To induce or assist coagulation of the blood in the sac other means have been suggested, and of these *the treatment by galvano-puncture* is one of the most promising in theory, but the practical results have not been equally satisfactory; it consists in the introduction of the two needles of a battery into the sac, in which an endeavour is to be made to coagulate the blood into a firm clot. The practice is one that can only be entertained in exceptional cases, *i.e.* in those which cannot from their position be submitted to other forms of operation, in aneurisms at the root of the neck and the thoracic aorta, and possibly in some abdominal aneurisms.

The constant current battery should be used and a moderate current be first employed, its strength being increased gradually, but never to cause pain. The battery may be used for half an hour at a time, about twice a week; but this will depend upon its effects. The needles should be introduced and removed with a rotatory motion. The needles may be attached to either pole of the battery.

Injection of sac.

THE TREATMENT BY INJECTION is another mode that demands notice, although hitherto it has not been satisfactory. Alcohol, tannin, acetic acid and the perchloride of iron have all been used as coagulating agents, but the last drug is the one for which the most can be said. That it has a powerful influence in causing the coagulation of the blood is well known; but to produce this in the sac of an aneurism by such means is a dangerous proceeding. The most dangerous result is embolism, and the next is inflammation and suppuration of the sac. A solution of the perchloride, diluted to one twentieth the strength of the Brit. Pharm.

solution, is quite strong enough, and not more than about twenty drops of the solution ought to be thrown into a large sac. The graduated glass syringe with screw piston should be employed, such as that generally used for subcutaneous injections. Care should be taken that the perforated trocar be well introduced into the cavity of the tumour, and that the afferent as well as efferent artery be well compressed. The escape of arterial blood is the only test of the trocar having entered the sac. The fluid should then be injected and by manipulation mixed with the blood. When the sac seems solid the canula should be withdrawn, but the pressure upon the cardiac side of the sac should be maintained for a good hour subsequently, to prevent the consolidating mixture of blood and iron being sent onwards into the circulation.

Moore's wire treatment.

With objects similar to the above the late Mr. Moore inserted twenty-six yards of iron wire into an aortic aneurism through a canula, his object being merely to detain the fibrine of the fluid blood; but the result was discouraging in the extreme. ('Med.-Chir. Trans.,' vol. xlvii.) Dr. J. Levis, of Philadelphia, in October, 1873, inserted twenty-four feet of horsehair into a thoracic aneurism in a man aged 41, with some advantage, and on November 25th, 1873, I adopted a like practice, and introduced into the sac of a rapidly increasing popliteal aneurism twenty feet of horsehair through a fine canula, with the effect of causing almost complete consolidation of the tumour. The patient was a man, æt. 33, with extensive heart disease. The man survived the operation five days, dying from ulcerative endocarditis, a condition that existed before the operation. The results thus obtained are, therefore, quite sufficient to justify a repetition of the operation, under circumstances in which all other plans of treatment are unjustifiable or have failed.

Subcutaneous injection of ergotin.

In recent times Langenbeck, with the view of causing contraction of the walls of an aneurism, has been led to inject the parts surrounding the sac with a solution of ergotin; and Dr. Dutoit, of Berne, relates in 'Langenbeck's Archiv' (Band xii, No. 3), a case in which he successfully adopted the practice; the man was forty years old, and the aneurism supposed to be subclavian; fifteen injections were made at intervals of two or three days *over* the tumour, which gradually diminished. To render the cure certain, however, digital compression was subsequently employed.

Traumatic Aneurism.

On traumatic aneurism.

This form of disease often arises in such ways as the following:—An artery receives a puncture or an incised wound; bleeding takes place; pressure is applied in order to control it, and the wound heals; in the course of time a pulsating swelling is discovered and a traumatic aneurism is said to exist. A man in wrestling, or after making some sudden unprepared-for muscular exertion, finds something give way in his leg, or fancies he has sprained his knee; in a shorter or longer period some swelling appears, which steadily increases and is pulsatile. This also is called a traumatic aneurism. In both these cases some external injury was clearly followed by the aneurism, in the *former* the injury undoubtedly, in the *latter* probably, caused the aneurism by acting upon a diseased vessel. And yet, if the aneurism is encysted either by the expansion of the reparative material with which the wound of the artery had been closed, or by the hernial protrusion of one or more of the coats of the artery through a rupture or wound of another, or by the condensation of the cellular tissue into which the blood has escaped, the case differs in no single practical point from any other aneurism that has been already considered; and what is more, it must be treated on the same principles, although as the artery of a traumatic is healthier than that of a spontaneously formed aneurism the former may show a greater proneness to cure.

Diffused aneurism.

When, however, an aneurism caused by any injury is not encysted; when either from the first it is diffused or becomes so from the rupture of the sac, a different condition presents itself to the Surgeon, and the case appears more like that of a ruptured artery; indeed, when such a condition complicates a sprain, fracture, or dislocation, it must be regarded as such, and treated accordingly. The vessel, however, is not to be cut down upon and tied at once as a matter of course, for such a practice would be wrong and rash in the extreme, a large proportion of cases such as these recovering without any such proceeding. In a case in which the extravasation is severe and no pulsation exists it is impossible to make out with any clearness the true condition of affairs. A limb either with or without a fracture may be greatly distended, and this from effused blood; but whether the blood has been poured out from the rupture of a large artery or vein, or some smaller vessel, there may be no means of knowing, for even the pulsation in the vessels below may be indistinguishable on account of the effusion. Under such circumstances no active proceeding can be carried out. The limb is to be elevated, cold applied, and the case left to nature, and in a large number of instances a good result will take place. I can recall several such cases where I looked for bad results, and witnessed good. Should the effusion be so severe as to be followed by evidence of arrest of circulation in the limb, the Surgeon will be justified in cutting down upon the vessel at the point where the history of the case indicates that it is wounded, and in tying both ends after having turned out all clot, &c. In other cases the main artery may be tied, but too often there will be nothing left but amputation; this operation being postponed till the line of demarcation is fairly indicated. No general rule can, however, be laid down for the treatment of all these cases; each one must be treated on its own merits.

Modes of treatment.

But the student should remember—(1) That every aneurism, however caused, if encysted, is to be treated upon like principles, and that ruptured traumatic aneurisms are to be regarded as ruptured arteries.

(2) That the rupture of an artery when bound down by a dense fascia, such as the popliteal, is generally followed by complete arrest of all circulation in the limb—both arterial and venous—and, as a rule, requires to be treated by amputation, gangrene being otherwise the result.

(3) That in cases of partial rupture there may be less extravasation. and consequently less severe measures may suffice; such as pressure upon the main trunk above, or, if this fail, the application of a ligature to the wounded vessel.

(4) That a ruptured artery in parts less fascia-bound than the leg, as the arm, &c., may be treated more as in the case of arterial injuries, by the application of a ligature to the wounded vessel.

On the collateral circulation after ligature.

When an artery is obstructed the circulation is carried on by what is called the collateral circulation, the vessels coming off from above the obstructed part communicating with those below. At first the vessels are very numerous, but as time goes on their number diminishes, only those most conveniently situated for carrying on the circulation becoming rapidly or gradually, permanently enlarged.

To illustrate this beautiful compensatory natural act I have given two drawings (Fig. 118, 119), taken from a preparation in the Guy's Museum, No. 1519^{12}, made by Mr. Cock in the year 1826, from a patient æt. 58, in whose case Sir A. Cooper had applied a ligature to the external iliac artery, eighteen years and a half previously, for femoral aneurism.

Fig. 118.
Anterior view.

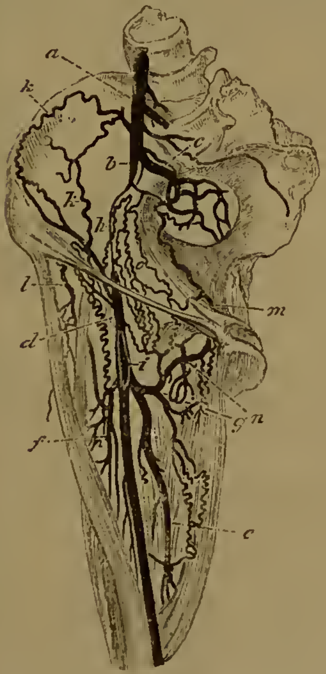


Fig. 119.
Posterior view.

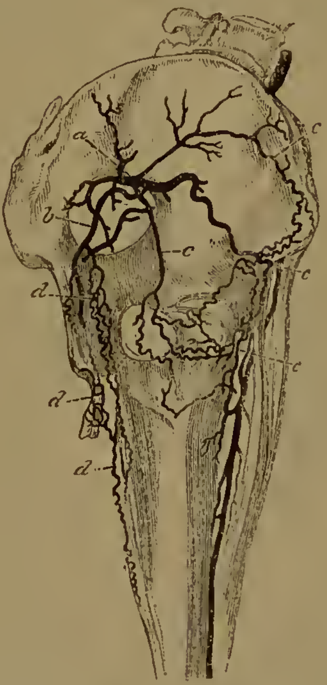


Fig. 118.—*a.* Common iliac artery. *b.* External iliac. *c.* Internal iliac. *d.* Femoral. *e.* Profunda. *f.* External circumflex. *g.* Internal circumflex. *h.* Iliac artery, which had been tied and had shrivelled into a cord. *i.* Remains of aneurismal sac. *k.* Anastomosing branches of the circumflexa ilii. *l.* Anastomosing branches of the circumflexa externa. *m.* Obturator artery, anastomosing with, *n*, circumflexa interna.

" 119.—*a.* Gluteal artery. *b.* Ischiatic artery. *c.* Anastomosing branches of gluteal with the circumflex. *d.* Anastomosing branches of ischiatic with the perforating branches of profunda.

A full description of the case and preparation is to be found in the first volume (first series) of the 'Guy's Reports,' by Mr. Cock. The drawings need no lengthy description, as they explain themselves.

Arterio-venous Aneurisms.

When an artery and a vein communicate with one another, the arterial blood passing *directly* into the vein without the intervention of a sac, *an aneurismal varix* is said to exist (A, Fig. 120); and when a

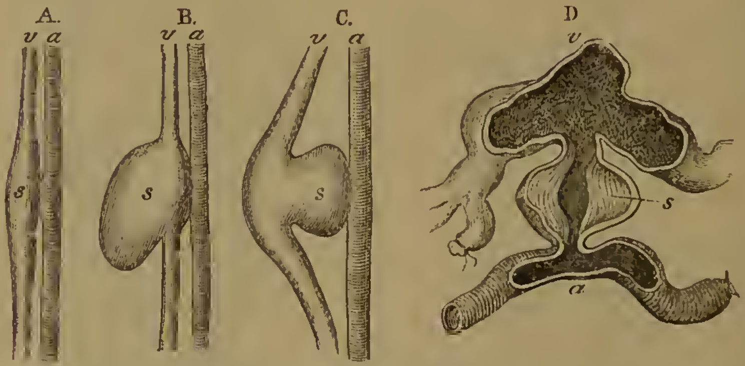
On arterio-venous aneurisms.

sac exists into which the arterial blood flows in its passage to the vein, this condition is called *a varicose aneurism* (B, C, and D, Fig. 120). Both

Varieties.

these varieties of arterio-venous aneurisms are now rare; but when venesection was a common operation they were far more frequent; for they are usually produced by the perforation or division of an artery through a vein, the opening between the vessels remaining permanent. Goupil (Paris, 1855) recorded the fact that out of fifty-seven cases of this affection thirty-one were the result of bleeding. But both forms may originate spontaneously. Cases are also on record where the aorta and superior or inferior vena cava communicated. Wade ('Dublin Med. Press,' 1861) has also recorded a case in which an opening existed between the aorta and pulmonary artery; indeed, all the large arteries and veins may be similarly affected.

Fig. 120.



Illustrating the different forms of arterio-venous aneurism. A, the artery and vein directly communicating. B and C, the dilatation being more in the vein. D, varicose aneurism laid open.

Aneurismal varix.

In an *aneurismal varix* the vein assumes in some degree the properties of an artery; it becomes enlarged from the arterial impulse, irregularly dilated and tortuous, the dilatation assuming a fusiform or sacculated appearance; it also becomes thickened and pulsates.

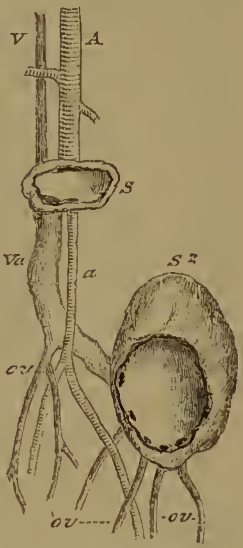
Varicose aneurism.

In the *varicose aneurism* the sac may or may not freely communicate with the artery or vein. In some cases it will involve the whole calibre of both vessels; or the vein may be hypertrophied and enlarged, as in the aneurismal varix. In a unique case (Fig. 121) recorded by Mr. Cock ('Med.-Chir. Trans.,' 1851), of a traumatic varicose aneurism of the popliteal artery, the sac was small, but involved the whole calibre of the artery and vein, and the whole of the arterial blood passed through it. The secondary effects of the disease were also shown with singular clearness. It occurred in a man æt. 28, who had received eleven years previously a punctured wound in the popliteal artery, for which two weeks subsequently, on account of secondary hæmorrhage, the femoral was ligatured. He convalesced and returned to his work, but two years later became the subject of "varicose veins." He remained well till three or four months before his admission into Guy's, where he had fever, and on convalescing and trying to walk discovered his leg was stiff, painful and swollen. He was admitted with what was supposed to be a large collection of pus beneath the superficial muscles of the calf. The femoral artery below Poupart's ligament and the anterior and posterior tibial arteries were pulsating freely. The cavity was opened, some ounces of dark grumous, pitchy, non-coagulable blood escaped; the next day a quantity of offensive pus flowed away mixed with coagula. For two weeks everything went on well, when arterial hæmorrhage took place; and he lost nearly three pints of blood. After due consultation amputation was performed, from which a good recovery ensued.

On dissecting the limb Mr. Poland found connected with the popliteal artery an aneurismal sac (Fig. 121, *s*) the size of a pigeon's egg; this was of cartilaginous hardness, and lined with fibrine. The artery (*A*) freely entered the sac from above. The vein (*V*) was obstructed above with coagulated blood, and below was lost in the walls of the sac as a fibrous cord. From the lower part of the sac two vessels issued, the smaller one (*a*) was the continuation of the popliteal artery *greatly diminished in size*, which divided as usual to the leg. The larger one (*v a*) was the popliteal vein greatly hypertrophied, pouched, and puckered. It was quite pervious, and passed down for about two inches, when it divided into two trunks; one, which accompanied the anterior tibial artery, was quite *obliterated*, the other led directly into a *second aneurismal sac* (s^2) the size of a duck's egg, with the walls of which its coats became identified. It was this sac that had been opened. From the lower part of this *venous sac* emerged three or four large impervious branches that were clearly veins accompanying the posterior tibial and peroneal arteries. The contents of these veins could be washed out and the valves seen.

It should be added that the cutaneous veins above described as varicose were greatly hypertrophied, and it must have been clear that the whole of the blood from the leg was returned through them.

Fig. 121.



Mr. Cock's case of arterio-venous aneurism.

In this case it would appear that, as a *direct* result of an injury, a *varicose aneurism* formed, into which the whole of the arterial blood flowed.

That the arterial blood subsequently found a more direct route through the popliteal vein than through the artery, and as a result the vein became hypertrophied and the artery atrophied.

That the force of the arterial blood current upon the thin coats of the vein caused the gradual dilatation of the vein and the subsequent formation of an aneurism in its course, from the giving way of which bleeding had taken place.

The wasting of the femoral vein above the upper sac is a point of interest, with the hypertrophy of the same vein below the sac, from its taking on the functions of an artery; and not the least interesting point is the great hypertrophy of the cutaneous veins, through which the whole of the venous circulation of the leg must have been carried on.

I have given this case at some length, as it illustrates better than any general description can do the whole effects, primary as well as secondary, of a varicose aneurism.

In reference to diagnosis it may be mentioned, that at the point of junction of the arterial and venous streams, a peculiar burring bruit is often to be felt and heard, this bruit frequently extending down the course of the dilated veins; and where a sac, in which the two blood currents meet, separates the artery and the vein there is likewise a soft bruit. The sac is seldom very large, and is made up of condensed cellular tissue and plastic matter.

Treatment of arterio-venous aneurism.

TREATMENT.—In neither of these cases is surgical interference generally called for. Should the disease be extensive, and either from pain, mechanical causes, or chances of rupture of the vessels, require treatment, a cure may be attempted by forcible flexion of the forearm on the arm, and supination of the hand, the brachial artery being in this way fairly obstructed; a pad may likewise be placed upon the point of communication between the two canals to make the pressure more perfect. Indirect compression in any other of its forms may also be tried; and on these failing the case must be treated as one of wounded artery, the vessel must be cut down upon, and a ligature placed on either side of the opening. The veins need not be interfered with, they will gradually wither as soon as their arterial communication has been cut off.

Cirsoid aneurism, erectile tumours, and aneurism by anastomosis.—These have nothing in common with the spontaneous and traumatic aneurisms that have been described, beyond being diseases of the arterial system. They are vascular tumours made up of arterial tissue and formed by a dilatation and elongation of arteries; the term cirsoid aneurism is employed when the trunks of the larger vessels are involved, and aneurism by anastomosis when the smaller vessels or capillaries are affected.

On cirsoid aneurism.

In the cirsoid aneurism one vessel or many vessels may be diseased, the disease showing itself by the artery becoming tortuous, dilated into pouches, and convoluted; when one vessel is alone affected Gosselin called it *arterial varix*. When the disease is upon the scalp, its most common seat, three or four large tortuous arteries may be seen converging to a centre, where a congeries of dilated arteries will be found, probably of new growth. It may, however, affect the arteries of the extremity. I have seen it in the foot, and Cruveilhier has reported a case in which the external iliac artery was so affected. Cirsoid aneurism is generally found in young people, during the period of growth, and in the majority of cases can be traced to local injury. It can be readily made out by its pulsating nature, and the peculiar tortuous and convoluted appearance of the diseased vessels, not only of the vessels forming the tumour, but of the arteries by which it is supplied.

Treatment of cirsoid aneurism.

TREATMENT.—All forms of treatment have been tried in these cases, such as direct pressure, injection, the application of ligatures to the vessels that converge towards the growth, and to the main artery that goes to the part: the tumour has, morever, been laid open and treated by pressure, with the view of causing its obliteration by inflammatory exudation; Gräf, Bell, Arnott, and Lawrence, have each recorded successful instances of this form of practice, but no good success in the majority of cases has been achieved.

The best success has, however, followed in the removal of the growth

Example.

either by the application of a ligature or by excision. In 1867 I treated a boy aged 14 for a large cirsoid aneurism of four years' growth situated on the right temple. It was supplied with blood by tortuous vessels converging from all quarters, and pulsated freely; I applied acupressure pins to all these vessels, even to their division, without success; the growth for the time became flaccid, but quickly reappeared and increased. Under these circumstances I excised the tumour, making my incisions at some distance from its margin, and ligatured about twenty large vessels as I proceeded; a rapid recovery followed, and the boy was well three years later. In this case it was remarkable to see how rapidly the tortuous convoluted arteries that supplied the tumour withered and became of their normal size as soon as the tumour was removed; this process illustrating John Hunter's opinion that "vessels have a power of increase within themselves, both in diameter and in length, which is according to the necessity, whether natural or diseased;" and pointing out the fact that the attracting power had its centre in the growth, and not in the afferent arteries. In a second case, that of a girl æt. 12, I removed the growth by a subcutaneous ligature with like success; and more recently in a man who had such a vascular pulsatile growth in his left cheek, which had had all the afferent arteries tied without success before he came into my hands, I ligatured the whole mass subcutaneously, and a lasting recovery has taken place. Indeed, the only successful cases of treatment of cirsoid aneurism that I have had or seen have been those in which the growth itself was treated and removed.

Cases of aneurism by anastomosis are very amenable to the treatment by styptic injection, the galvano-cautery, or the ligature.

Nævus.

On nævus.

Arterial.

Venous.

Telangeiectasis, Erectile Tumour, or Angeioma, is essentially a disease of the capillaries, seeming in a rough way to be made up of a mass of vascular tissue, the tubes freely intercommunicating with one another. It is true the walls of the vessels are indistinguishable in an advanced example of the disease, the nævus appearing as a collection of cells or spaces, opening widely into one another, through which blood flows. When the arterial supply is very free, the growth appears florid, warm, and pulsatile, it is then called an *arterial nævus;* when the venous element predominates the growth is less florid, has a congested bluish appearance and does not pulsate, this is called a *venous nævus.*

Cutaneous.

Subcutaneous.

These growths for the most part appear in the skin or subcutaneous tissue, are frequent on the head and often multiple; although rare examples are on record where they affected deeper parts, even the viscera. In a clinical point of view they may be divided into the *cutaneous* or pure skin nævus, the *subcutaneous* or cellular tissue nævus; and the *mixed form* where both tissues are involved; and this distinction has an important practical bearing. Nævi are as a rule diffused that is, they have no distinct capsule, but in many cases they are encysted, and may be treated accordingly; venous subcutaneous nævi appear to be more frequently encapsuled than the cutaneous and arterial.

Congenital.

Nævi are, moreover, generally congenital or make their appearance soon after birth; they do occur, however, at a later period of life and then seem to be due to some injury or wound. At times these nævi grow

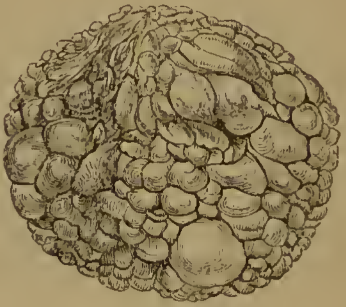
Their progress.

quickly, the cutaneous form rapidly spreading; the more florid and arterial the growth is the greater its tendency to spread, but the venous nævus is less progressive. They may grow also for a time and then stop; indeed they all have a tendency to become stationary after a period, and even to degenerate. It is not uncommon to meet with nævi that have begun to undergo this process before the birth of the child; and I could give many cases in which the nævus was ulcerated or even sloughing at birth. In feeble or cachectic children it is not uncommon for these "marks" to ulcerate or slough, and after measles, fever, or other depressing cause, the destruction of the growth is sometimes very rapid. These facts show that nævi—although blood tumours—are not long-lived growths, and have an early tendency towards death. When they do not ulcerate or slough they undergo degenerative changes, and the most characteristic is the cystic form (Fig. 122). When the skin undergoes this change the surface becomes warty and vesicular, the vesicles containing more or less blood-stained serum; when the cellular tissue is the part involved, cysts will still appear of a like nature, but at times the whole growth passes into a mass of cysts of different sizes bound together by fibre tissue. This degenerative change is very typical. To account for the formation of these cysts is no easy matter, indeed no satisfactory explanation of their production has yet been given.

May ulcerate.

May degenerate.

Fig. 122.



Drawing of degenerating nævus.
Guy's Mus., 160⁵⁴.—Hilton's case.

Pigmentary nævi.

Some nævi are pigmentary and are then called moles; they are far less vascular than the forms already alluded to, and have no such tendency to spread. They grow, it is true, with the growth of the subject, but in no greater proportion as a rule; in exceptional instances their increase may be rapid. They do not appear to have a tendency to ulcerate, slough, or undergo the cystic degeneration like the vascular nævi, but have a special tendency to become the seat of cancerous disease, and particularly of the melanotic form. That is to say, subjects who become the victims of cancer, and have moles, are often attacked primarily in such structures, and as the cancer originates in a pigmentary growth, it takes on its character and becomes melanotic. I have seen very many of such cases, and so many have been now recorded as to place the question beyond doubt.

Treatment.

Treatment.—Unless a nævus be so situated as to be an eyesore or an inconvenience, or unless it show a decided tendency to

When interference called for.

Caustics.

Cautery.

rapid increase, there is no necessity for operative interference; it will for a certainty, after a time, cease to grow, and will also as certainly degenerate or waste; and under such circumstances it is not necessary to interfere. Should, however, the nævus be so situated as to be an inconvenience or a deformity; or should it grow so rapidly as to threaten to become either, something must be done, and this something is to be determined by the nature of the nævus and of the tissue in which it is placed. If *purely cutaneous* and not involving deeper tissues it may be destroyed by some external application, such as caustics, nitric acid, or potassa fusa, chloride of zinc, or tartarized antimony, the former two being applied directly to the part, the latter two in the form of Vienna paste or otherwise. The hot iron and the gas cautery are also very valuable destructive agents; but the galvanic cautery is to be preferred above all; one touch of this, steadily applied, destroys the growth, and with but little pain.

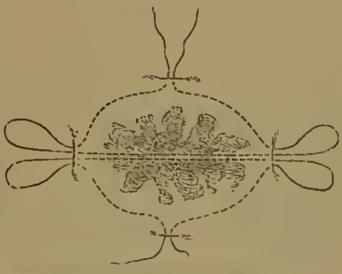
Excision.

Sub-cutaneous ligature.

Injection.

In the *purely subcutaneous nævus* the treatment by caustics or cautery applied as a caustic is clearly inapplicable. When encysted, as very often it is, excision is the best practice, saving the skin; when this practice cannot be followed it may be strangled by a ligature applied subcutaneously, as illustrated in the drawing Fig. 123, or injected with the perchloride of iron, of the pharmacopœia strength, with a solution of tannin in water in the proportion of ʒj to ℥j, or of the chloride of zinc grs. xij to ℥j of water, about twenty drops being thrown into the centre of the growth. The object of this treatment is to coagulate the blood in the tissue, and thus cause its consolidation and cure. In many cases injection causes inflammation, suppuration, or even sloughing of the growth, and although in this way a cure may be obtained, it is often by deformity,

Fig. 123.



Mixed nævus with the ligatures inserted round its base subcutaneously before being tied.

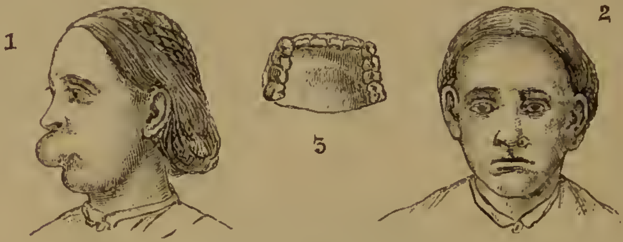
Dangers attending injection.

This treatment by injection is, however, when the nævus is on the head or trunk, attended with great danger, that of embolism more particularly. I lost one patient in whom the nævus was on the cheek from this cause in a few minutes after the operation. For the above reason it is a good practice to apply a ligature to the base of the growth, and then inject should the ligature prove insufficient.

In the *mixed variety*, when the skin appears to have been involved secondarily by the extension of the disease from the cellular tissue, the nævus may be treated as in the last form, viz. by excision, subcutaneous ligature, or injection.

When the skin is extensively involved with the cellular tissue, and the nævus is defined, the whole may be removed by excision; when otherwise, by ligature. When the nævus is pendulous, or when it can be isolated from the parts beneath, excision is most applicable, and when hæmorrhage is dreaded the base of the growth may be previously held in a flat clamp. In many instances I have excised the nævus by cutting on pins that have been inserted beneath its base; keeping the pins as points, round which a ligature might be applied, and by which the edges of the wound might be brought together. When the thickness of the lip is involved in the disease, and the disease is limited, a V piece may be taken out with the growth advantageously, and when the whole lip is involved the growth may be dissected out, leaving the skin. The drawing below is of a case in which the operation was successfully employed (Fig. 124).

Fig. 124.



1. Nævus involving the whole of the upper lip. 2. After removal.
3. Flattening of the teeth from the pressure of the nævus (from 'Guy's Reports').

Within the last few years I have successfully treated many of the mixed varieties of nævi with the galvanic cautery, by simply perforating the nævus with the heated needle in many points.

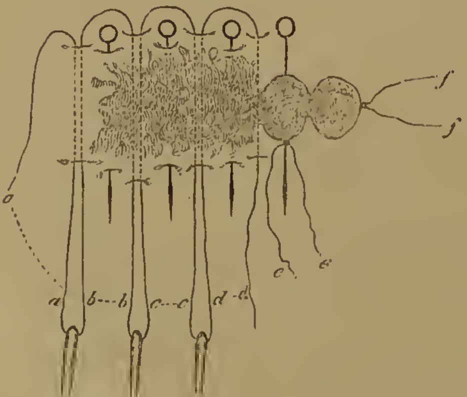
Setons in diffused nævi.

The treatment of a diffused nævus by means of setons is a practice that can be strongly recommended. Several setons steeped in the solution of the perchloride of iron are often sufficient to coagulate the blood or set up enough inflammatory action to cure the growth. In diffused mixed nævi this mode of treatment ought to be selected.

Piecemeal ligaturing.

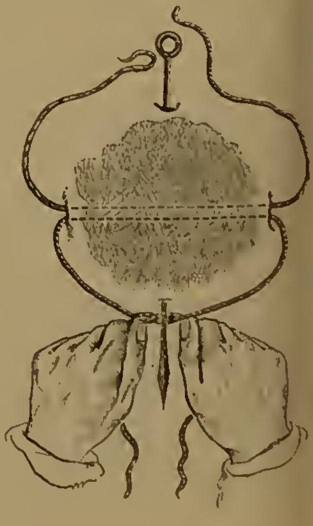
When a nævus is extensive and is to be treated by the ligature, it may be dealt with piecemeal (Fig. 125); it occasionally happens that the liga-

Fig. 125.



Illustrating the method of ligaturing a large mixed nævus in sections around pins. At one end the pin has been removed, and the knot completed (*f*).

Fig. 126.



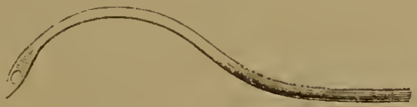
turing of half a nævus cures the whole by the extension of the inflammatory action. In nævi about the eyelids this suggestion is of value, and, in my own practice, several instances of cure have followed the application of a ligature to half the growth.

In a mixed nævus of moderate size, when the cure by ligature is to be carried out, a pin may be passed beneath the growth and a needle at right angles armed with a double ligature (Fig. 126). The nævus is strangled in halves by the ligature tightly drawn beneath the pin; before the ligatures are finally tightened it is well to puncture the nævus to let out the serum and blood that it contains, to relieve tension, and allow of the more perfect strangulation of the growth; when this act is completed the pin may generally be removed.

Small nævi may be vaccinated, although the chances of a cure by such means are very poor. The same must also be said for compression.

The best needle for the application of a subcutaneous ligature to a nævus is figured below.

Fig. 127.



Richet, "Aneurism," in 'Dict. de Méd. et de Chir. Prat.,' vol. ii.—*Léon Le Fort*, 'Diction. Encyclopédique des Sciences Médicales,' 1866.—*Broca*, 'Traité des Aneurysmes,' 1856.—*Lisfranc*, 'Des différens Méthodes, &c., pour l'Oblitération des Artères,' 1834.—*Scarpa*, 'On Aneurism,' Wishart's Translation.—*Bellingham*, 'On Aneurism,' 1847.—*Tufnell*, 'On Treatment of Aneurism by Compression,' 1851.—*Holmes*, 'System of Surgery,' 2nd ed., 1870.—*Hodgson*, 'On Arteries and Veins,' 1815.—*Dr. Norris*, 'American Journal.'—*Dr. Stephen Smith*, Ditto.—*Erichsen's* Cooper's 'Surgical Dict.,' 1861.—*Wardrop*, 'Cyclop. of Surgery.'—*Syme*, 'Observ. in Clinical Surgery,' 1861.—*Fergusson, Sir W.*, 'Med.-Chir. Trans.,' vol. xl.—*Dr. Jones*, 'On Hæmorrhage.'—*Bryant*, 'Lancet,' April 4th, 1874.

THE LIGATURE OF ARTERIES.—SPECIAL ANEURISMS, &c.

Importance of anatomical knowledge.

The right way of securing a great artery is perhaps one of the most important points in practical surgery, wrote John Bell seventy years ago; and to do this with nicety and precision requires a sounder and more accurate knowledge of anatomy than any other operation.

"Before undertaking to tie an artery, the Surgeon ought to know its general course and its relations, and especially the prominent part or parts which are to guide him to the position of the vessel; he ought to have familiarised himself by frequent dissection with the thickness of the parts covering it, and their appearance as far as that can be judged of in the dead body; and finally, he ought to know the usual position of its principal branches, and the anastomosis by which the circulation may be expected to be restored. It is advisable also to be aware of the leading peculiarities in course, relations, bifurcation, &c., which the operator may perhaps meet with, and for which he ought to be prepared." ('Holmes's System,' vol. iii, p. 545.) In fact, without anatomical knowledge, any attempt to tie the trunk of a large artery must be surrounded with difficulties and fraught with danger, whilst with i the operation becomes in the hands of an experienced Surgeon an act o precision and apparent simplicity.

In a former chapter the mode of applying a ligature to a divided artery, after operation, was discussed and illustrated; in the present one, attention will be directed to the application of a ligature to an *artery in continuity,* as in the operation for aneurism or the arrest of hæmorrhage from a punctured wound. To do this the Surgeon has to go through several stages of thought as well as of action. He has *first* of all to make out with precision the *exact course of the vessel to be ligatured;* this is done by the recollection of the anatomical relations of the vessel, the muscular guides to its position, and the artificial linear guides with which he ought to be familiar.

General rules to be observed in operating.

He has, *secondly,* to decide upon *the point at which the ligature is to be applied.* When for a *wound* in the vessel this point is already settled, for it has been laid down as a rule that, whenever possible, a wounded artery is to be exposed at the seat of injury, and two ligatures are to be applied, one above and one below the seat of lesion.

When *for aneurism* the question is more open, the "point of selection" having to be determined by the Surgeon. In deciding this important question, it is to be remembered that, if the ligature be applied *too near* the aneurism, there is a risk of the ligatured vessel partaking of the disease for which the operation is called for; and if *too far off,* the circulation through the aneurismal sac may be too free on account of the collateral circulation of the part, and thus interfere with or prevent recovery taking place.

But above all, the Surgeon should avoid selecting a spot *where an artery bifurcates, or gives off large branches;* for under these circumstances, the clot that is required to plug the vessel behind the ligature must be absent, and one of Nature's most important hæmostatic agents will be lost.

With the decision of these primary important points, the operation itself has to be considered, and this resolves itself into *the exposure of the artery, its isolation, the application of the ligature around it, and the after-treatment;* the position of the patient for operation having been previously determined.

Position of patient.

The position of the patient should be such as to render prominent the anatomical guides to the course of the artery, to make the skin tense to facilitate its division, and to be easy to the patient. *It should be one of extension,* but these ends having been secured, and the artery exposed, it is well to remember that the muscles of the part should then be *relaxed,* the artery being thus better brought into view and the subsequent steps of the operation rendered more easy.

Exposure of artery.

The exposure of the artery is to be made by incision, its course having been clearly made out beforehand, and the point for the application of the ligature determined on. The incision should be in the course of the vessel, its centre corresponding to the point where the ligature is to be applied, an occasional obliquity being sometimes practised when the exact position of an intermuscular interspace, in which the vessel lies, is uncertain, and when the artery lies deep. It should, moreover, be free. In a thin subject it need not be so long as in a fat one, nor in the case of a superficial artery as in that of a deep; but, under all circumstances, the skin wound should be enough to allow of a free exposure of the vessel that is to be ligatured, and room for manipulation.

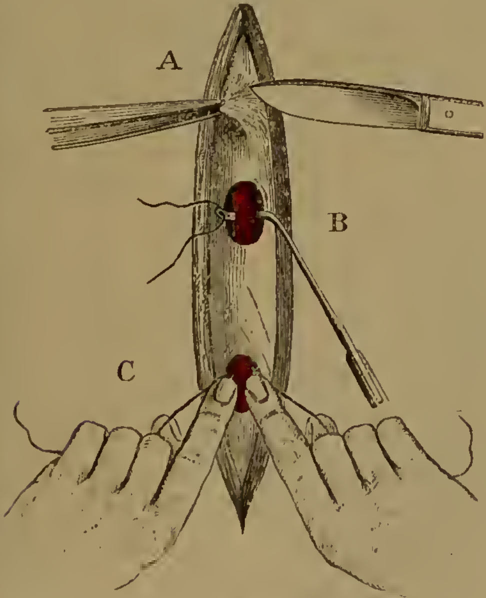
First incision.

The first incision should include the skin and superficial fascia down to the deep fascia, and in making it the operator has only to avoid the division of any large vein; such as the external jugular in operations on the neck; or saphena, in operations on the thigh. He should, consequently, mark out their position by arresting the circulation through them on their cardiac side, and make his incision parallel with them when they lie in his course.

When the deep fascia is exposed, it is to be laid open, and in this step the use of a director is sometimes of value; the fascia is, moreover, always to be divided to the full extent of the external incision. The student should remember, that the trunks of all arteries, except the cutaneous, are covered in by fascia. With the division of the fascia, the use of the knife may for a time be dispensed with, for the intermuscular septa and cellular tissue are readily separated by the handle of the instrument or finger, and the sheath of the vessel is thus well exposed.

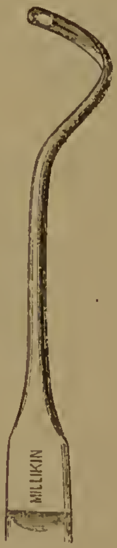
If immediately after the first incision, writes Malgaigne, the Surgeon attempts to find the artery, he tries an impossibility, since he cannot reach it till after the last incision. He will then proceed uncertainly, and at random—whence the following rule of the guiding points:—"The Surgeon should not at the commencement occupy himself with looking for the artery, but should seek the first marked point of guidance, then the second, then the third, and so on to the end."

FIG. 128.



This diagram represents three distinct operations.
A. Opening the sheath. B. Drawing ligature round the artery.
C. Tying artery.

FIG. 129.



In looking for the sheath, every anatomical guide is to be made use of to prevent undue manipulation or separation of parts.

When the sheath is found, and the pulsating artery is felt within, the end of the operation is not far off. Still many errors may be committed. Every possible error should consequently be thought over beforehand, in order that it may be avoided. The operator must ask himself as to the position of the nerves and veins about the part, in order to avoid them. He need not look for them, as he would in a dissection, for this would necessitate superfluous manipulation, but their existence must be present in his mind. He need only remember their relative position to the vessel where the ligature is to be applied, and guard against their being injured. The sheath having been found, it is to be raised by the forceps, and carefully opened (Fig. 128, A), the opening being only sufficient to admit a probe or aneurism needle, for the less the sheath is separated from its vessel the better. The needle (Fig. 129) with the ligature is then to be passed (Fig. 128, B), and it is well to introduce the needle between the artery and the vein, for when it is passed the other way the vein may be perforated or mistaken for fascia; but this point in the hands of a careful Surgeon need not weigh against convenience. With the exposure of the artery all anxiety ceases, for, to put an ordinary silk, hemp, or catgut ligature around it, is a comparatively easy task with the majority of arteries; and when this is done the operation, as such, is nearly completed. To do this, however, the Surgeon must be careful not to elevate the artery from its bed by the ligature, but to tie the knot with his fingers well passed down to the vessel (*vide* Fig. 128, C). He should also satisfy himself when the vessel is on the needle that pulsation exists, and that pressure upon it arrests pulsation in the aneurism. When the ligature has been applied, the displaced parts must be readjusted, the wound cleansed, its edges brought together, and some light application such as water dressing, employed. Where the artery of an extremity has been tied the limb should be raised, to facilitate the venous circulation, and cotton wool wrapped round the part to maintain its heat, but beyond this no local treatment is required. It need hardly be said that chloroform should always be given in these operations, and that the subsequent treatment of the case should be based on general principles. When veins bleed or when large venous trunks must be divided, they may be tied or twisted, but gentle pressure often arrests bleeding from small vessels. The wound is to be carefully sponged clean during the operation by the firm pressure of a well-squeezed sponge, and the edges should be held apart after the sheath has been exposed by hooked directors, but the Surgeon should on no account allow his assistants to draw the parts so far asunder as to make them lose their relative positions. With these general remarks, the application of a ligature to special arteries will now claim attention.

Opening of sheath.

Passing of needle.

Care in ligaturing.

Chloroform to be given.

Veins may be wounded.

Ligature of the Abdominal Aorta.

In 1817 Sir A. Cooper tied the abdominal aorta, having failed to find the communication between the common iliac artery and an aneurismal tumour after the introduction of his finger through a small opening in the ruptured sac. He made his incision through the linea alba to the left of the umbilicus, directly over the aorta. The patient

On ligature of the abdominal aorta.

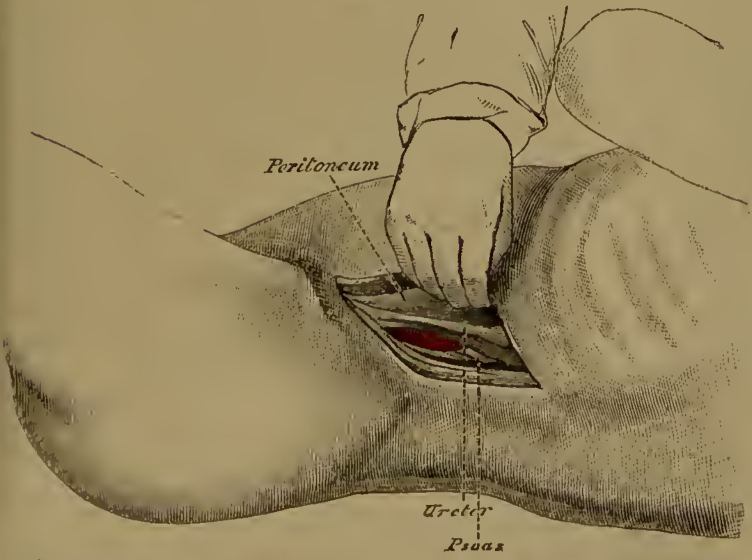
lived forty hours. James, of Exeter (1829), and Murray, of the Cape of Good Hope, followed his example with no better success, the patients surviving three and a half and twenty-three hours respectively. In 1842 ('Lancet,' p. 334) Dr. C. B. Monteiro, of Rio Janeiro, recorded a case in which the patient died from hæmorrhage on the tenth day. In 1856 Mr. South ('Lancet,' vol. ii) operated on a patient who lived forty-three hours. In 1868 ('American Journal of Medical Science') Dr. McGuire, of Richmond, Virginia, recorded a sixth case, in which the patient lived twelve hours. In 1869 Dr. P. H. Watson, of Edinburgh ('Brit. Med. Journ.,' 1869) is said to have performed the operation on a man who survived it sixty-five hours; and in the 'Dublin Quart.' for 1869 Mr. Stokes, junior, has recorded an eighth case in which a temporary ligature was applied, but without success.

Cure of abdominal aneurism by pressure.

In all these cases the operation was performed for aneurism of the common iliac artery, but the results up to the present time offer but little encouragement for its repetition, more particularly when we have other means at our command that hold out a better promise of success, such as pressure by the abdominal tourniquet, while the patient is under the influence of chloroform, cases of cure of abdominal aneurism by these means having been recorded by Dr. Murray, of Newcastle-on-Tyne ('Rapid Cure of Aneurism by Pressure,' 1871), Dr. Heath, of Sunderland ('Brit. Med. Journ.,' 1867, p. 287), Mr. Holden ('St. Barthol. Hosp. Rep.,' 1866), Dr. Moxon and Mr. Durham ('Med.-Chir. Trans.,' 1872), and Dr. Greenhow, ibid., 1873.

Nevertheless, I believe the operation of placing a ligature upon the abdominal aorta to be a justifiable one under exceptional circumstances, such as in cases of aneurism of the common iliac artery when all other means are inapplicable.

FIG. 130.



Incision for the application of a ligature to the aorta or common iliac artery.

The best indirect incision by which to reach the abdominal aorta is a modification of that adopted by Sir P. Crampton in the case of the common iliac artery (Fig. 130), viz. one extending from the anterior superior spinous process of the ilium of the left side to the cartilage of the tenth rib, the peritoneum being reflected. The great difficulty in this operation is in the application of the ligature to the vessel. The best direct incision is through the abdominal walls on the vessel as practised by Dr. Watson.

Ligature of the Arteria Innominata.

On ligature of the arteria innominata.

The first operation was by V. Mott, of New York, in 1818, and since then this artery has been tied twelve times, but only once with success, and in that case (by Dr. Smyth, of New Orleans, in 1864) the carotid and vertebral arteries were likewise ligatured, the former at the same time as the innominata, the latter one month afterwards for secondary hæmorrhage. Dr. Smyth did this on the suggestion made by Mott in 1818, when he wrote, "by thus intercepting the retrograde current through the primitive carotid there would be less chance of any reflux hæmorrhage in the event of a phagedænic ulceration taking place in the wound." In all the other cases a fatal result rapidly occurred. It can only be entertained, therefore, in cases of injury to the carotid or subclavian near their origin, or in exceptional cases of disease. When decided on the operation should be proceeded with as follows:

Operation.—The head being thrown back to the left, and the shoulder depressed, the vessel may be secured by making an incision along the anterior border and sternal origin of the sterno-mastoid muscle; or by a transverse one over the upper border of the clavicle, making its centre correspond to the upper border of the sterno-clavicular joint; or by both combined. Under all circumstances, the sternal, and sometimes a part of the clavicular, origin of the muscle will require division. The carotid artery with its sheath will then come into view, with the internal jugular vein on its outer side, and the vagus nerve between. On tracing these downwards, the innominate vessel will be reached. In a healthy subject the artery is always to be found behind the right sterno-clavicular joint, but in disease its relative position may be altered by mechanical displacement. Dr. Cooper, of San Francisco, has reached the artery on two occasions by removing the sterno-clavicular articulation.

Cooper's operation.

On aneurism of the innominate.

In aneurism of the innominate there is no possibility of applying a ligature to its cardiac side, even if the disease involves so little of the artery as to admit of the practice being entertained, for this form of aneurism is almost sure to be associated with dilatation of the aorta. The distal operation, however, may be thought of, the carotid and subclavian arteries being ligatured simultaneously or consecutively; out of five instances in which the former practice was followed one (Ensor's case, 'Lancet,' July 31, 1875) lived sixty-five days, and one recovered; and out of three of the latter an equal success may be recorded.

Brasdor's or Wardrop's.

The credit of the successful case in the former class, for a success I take it to have been, belongs to Mr. C. Heath, who tied the subclavian artery in the third part of its course and the common carotid simultaneously in 1865. The operation was followed by marked relief, and the diminution of the tumour; the woman, æt. 30, survived the operation four years, and died from rupture of the aneurism. After death the aneurism was found to be of the aorta, the innominate being only slightly involved. (*Vide* Prep. in Mus. of Royal Col. of Surgeons, and 'Path. Trans.,' vol. xxi.)

The successful issue to the case in the latter class belongs to Mr. Fearn, of Derby, who tied the carotid in 1836, and the subclavian in the third part of its course two years later for innominate aneurism. The patient died four months after the second operation from pleurisy. I had an opportunity in 1866 ('Path. Soc. Trans.,' vol. xviii) of carefully examining and reporting on this preparation, which is now in the College of Surgeons' Museum, and a better specimen of a cured small sacculated aneurism could not possibly be seen.

Aneurism of the innominate has likewise been treated by ligature of the subclavian or common carotid alone, Wardrop's operation; and in 'Holmes's Surgery' a most interesting list of references to such cases, collected by Mr. Heath, is to be found. Out of eighteen cases, Evans's case, as recorded by Wardrop, was cured, his own lived two years, Morrison's case lived twenty months, two others lived six months, and the rest lived only a few days or weeks.

In August, 1871, I ligatured the subclavian in a man, æt. 33, for this affection, and a rapid convalescence followed, with great diminution and consolidation of the aneurism. The man lived three years after the operation (*vide* page 435). This result, then, is not so discouraging as to preclude the question of operation in favorable cases. It can only, however, be entertained under exceptional circumstances, and then as palliative rather than curative treatment.

Ligature of the Common Carotid Artery.

Ligature of the common carotid.

This operation was first performed for aneurism by Sir A. Cooper in 1805, but it was unsuccessful. The same Surgeon had, however, a successful case in 1808, the man surviving thirteen years ('Guy's Hosp. Rep.,' vol. i). The operation may be demanded for aneurism or erectile tumours of the trunk itself, or one of its branches, in the orbit, on the scalp, &c., and for wounds or hæmorrhage. It is a dangerous operation, and sometimes a difficult one, but in a moderately thin subject it may be performed with facility; it is only to be done when all other means of treatment are inapplicable or have been found ineffectual, and for aneurism it ought not to be performed unless the treatment by digital compression has been rejected, Holmes well summing up the matter in his College Lectures, 1873, as follows:—"That the experience of Surgeons hitherto leads to the conclusion that aneurism of the trunk of the carotid artery may be very often treated successfully by compression, and that the cure by compression frequently leaves the artery unobliterated, and therefore exposes the patient to far less risk of cerebral mischief than the ligature; that the ligature of the carotid for such tumours is extremely dangerous and ought not to be undertaken until attempts, well devised and perseveringly carried out, have failed to effect the cure by compression; and that when the Surgeon has been compelled by the position of the tumour to place his ligature close to the proximal side of the sac, it is worth very great consideration whether it would not be better to evacuate the tumour, and tie the distal part of the artery also; finally, that cases do occur in which Brasdor's method holds out a rational hope of cure, but that this operation ought not to be practised except in cases of growing aneurism, when digital pressure checks the pulsation of the tumour, yet has failed to effect a cure." ('Lancet,' June, Place of selection.

1873.) The vessel may be ligatured in the upper part of its course, at the apex of the carotid triangle, in a line with the cricoid cartilage, or it may be ligatured lower down; the former position is the better and easier of the two, and for disease of any of the branches of the vessel it should be selected. The latter should only be employed for disease or wound of the upper part of the trunk itself. The course of the artery can always be made out, corresponding as it does with a line drawn from the sterno-clavicular joint to the angle of the jaw; it divides at a line on a level with the upper part of the thyroid cartilage, and should be tied opposite the cricoid. The centre of the incision should consequently correspond to this point, and it should extend about three inches along the anterior margin of the sterno-mastoid muscle. The position of the patient should therefore be such as to render this muscle prominent, and this is ensured by the extension of the head backwards, the face being turned to the opposite side.

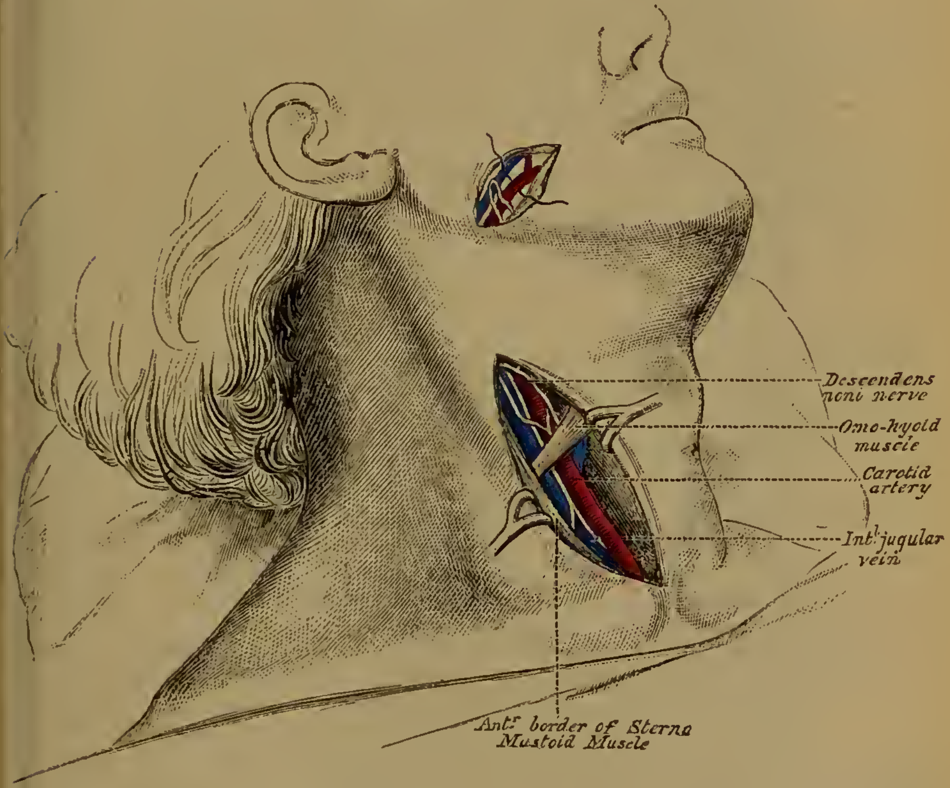
Description of operation.

Before making the first incision through the skin, platysma, and superficial fascia, the Surgeon should assure himself that no large vein, such as the anterior jugular, is likely to be divided; gentle pressure below, enough to interfere with the venous circulation of the part, readily gives this information. The deep fascia covering in the sheath of the vessel may then be divided, care being taken to do this to the whole extent of the external wound. The sheath of the artery will then come into view, lying between the trachea and sterno-mastoid muscle; the pulsation of the vessel may likewise be detected. The head of the patient at this stage of the operation should be slightly raised, so as to relax the sterno-mastoid muscle, and allow its being gently drawn out by means of a retractor, as well as the separation of the cellular connective tissue of the part. The anterior belly of the omo-hyoid muscle will then probably be at once visible, with its fibres passing downwards and outwards, and when this muscle is broad it will cover in a great part of the vessel. The descendens noni nerve may likewise be seen lying upon the sheath, or sometimes within; and due care should be taken that it is not wounded or included in the ligature; should it be in the way, it must be gently held aside by a retractor, as should any large vein that crosses the sheath. The inner border of the sheath is then to be taken up with forceps, and firmly held, a sufficient opening being made in it by the knife, held with its flat surface towards the artery, to allow of the introduction of the aneurism needle; the needle is generally recommended to be passed *armed*, but this is not a point of importance, and *unarmed* it is passed with greater facility; by a little manipulation the needle may then be passed round the artery from without inwards, introducing it between the vein and vessel, its point being kept close to the artery. The sheath may then be dropped from the forceps, the loop of the ligature seized or needle threaded, and the needle withdrawn. The Surgeon should, however, satisfy himself beforehand that the right vessel has been exposed, and that the vagus nerve is not included. The vessel may now be tied, great care being observed that it is not raised from its bed or manipulated more than is necessary; the knot should be tightened by the index fingers passed well into the wound. The wound should then be adjusted and the patient put to bed, the most perfect quiet being enjoined. The Surgeon must remember all through this operation that the jugular vein is on the outer side of the artery, and often overlaps it; that the vagus nerve is behind, and the descendens noni in front (Fig. 131). None of these parts need, however, be looked for as long as care is observed that they are neither wounded nor included in the ligature.

Ligature of carotid in lower part.

The operation for ligaturing the *lower part of the carotid* is very similar to the above; the operation is more difficult from the vessel being deeper, particularly on the left side. The incision should, however, extend lower down over the sterno-clavicular articulation. The muscles will also require more retraction, and probably some division. The ligature will probably separate about the fifteenth day, but at times the period will be longer; till that day the less it is disturbed the better, the gentlest traction only being applied to draw it out of the wound. Should its discharge be, however, retarded, the ligature may be twisted daily on its own axis, to facilitate its separation, but this is to be done with extreme caution.

Fig. 131.



(This figure, with many others in this chapter, is based upon those given in Sedillot's work.)

Key's case.

Mr. Cock has related to me a case, which he authorises me to quote, in which Mr. Aston Key applied a ligature to the left carotid for aneurism and the man died on the table; simply dying on the application of the ligature. After death it was found that the right carotid had been previously obliterated, and the operator had, by ligaturing the left, so interfered with the supply of blood to the brain as to cause death. Such a case as this is unique, and deserves a place in the records of our profession.

Prognosis of ligaturing in common carotid.

With respect to the prognosis after this operation, much depends upon the object for which it is performed. Dr. Pilz, of Breslau, whose statistics are the most recent ('Langenbeck's Archives,' 1868), makes out that 43 out of every 100 die. He says that of 228 cases in which the operation was performed for hæmorrhage, 128, or 56 per cent., were fatal; of 87 for aneurism, 31, or 35 per cent., died; of 142 for tumours, 49, or 34 per cent., died; of 71 for extirpations, 25 died, or 35 per cent.; of 34 for affections of nervous system, one only died, or 3 per cent.; and of 38 for aneurism, on the distal or Brasdor's method, 25 died, or 65 per cent.

Secondary hæmorrhage is a common cause of death, but brain complications are the more frequent, abscess in the brain and atrophic softening, from want of arterial supply, being the usual form—local gangrene, as it were, of the brain. Brain symptoms in some of their forms also frequently occur after the operation, when death does not take place simply from altered cerebral circulation. Suppuration of the aneurismal sac is not infrequent; in a case of my own it was the cause of death.

Ligature of external carotid.

Ligature of the external or internal carotid artery is very seldom performed, the ligature of the common trunk being preferred. In certain wounds of these arteries near their origin, a ligature may, perhaps, be placed upon them, but the uncertainty of the position of the bleeding point renders the ligature of the common trunk preferable. In the 'New York Med. Journal,' January, 1874, a case of successful ligature of the internal carotid artery for secondary hæmorrhage is recorded by Dr. H. P. Sands, of New York. Cervical aneurisms situated on one of the secondary carotids should be diligently treated by compression, and the Hunterian operation performed only when the treatment by compression has failed.

Should the Surgeon be called upon to tie the external carotid, he may do so by adopting the same rules as have been given for the common carotid; the incision should, however, be higher up. The course of the vessel follows the same line as the common carotid, starting from the upper part of the thyroid cartilage.

Ligature of the lingual artery.

The lingual artery has been ligatured for wounds of the tongue and of the artery itself, to check the growth of cancerous tumours, or arrest hæmorrhage from their substance, and the operation is a difficult one. The trunk of the vessel is always to be found at a point *above the great cornu of the hyoid bone*, and this point must be rendered prominent by the head being well drawn over to the sound side. The best incision is a horizontal one, on a level with the hyoid bone, its centre corresponding to the end of the greater cornu. The skin and fascia having been divided, the submaxillary gland will become exposed. On hooking this upwards the hypoglossal nerve will be seen resting on the hyoglossus muscle. Beneath this muscle, and at a lower level than the nerve, the artery will be found. It will be in close contact with the tendon of the digastric muscle. The fibres of the hyoglossus will always require division to allow of the ligature being applied. Fig. 132 illustrates these points.

A good paper on this subject, by M. Demarquay, may be referred to ('Gaz. Méd. de Paris,' 1867).

The facial artery is always to be found close to the anterior border of the masseter muscle. It is only covered in by skin, platysma, and fascia; a transverse or oblique incision at the lower insertion of the muscle will expose the artery, where it may be ligatured. (*Vide* Fig. 131.) It is difficult to understand under what circumstances this operation can be called for, as the artery can be so readily controlled by pressure, an acupressure needle and twisted suture over it being the best form to employ.

Ligature of the facial artery.

The temporal artery can always be found and pressed upon in front of the pinna of the ear, over the zygoma. It lies buried in the dense cellular tissue which exists in this spot beneath the skin and fascia. It can be readily exposed by a vertical or oblique incision, an inch long, one third of an inch in front of the tragus.

Ligature of the temporal artery.

The occipital artery can be traced by a line drawn from the mastoid process to the occipital protuberance; it lies beneath the skin and cranial aponeurotic origins of the sterno-mastoid and splenius muscles, and these must be divided to reach the vessel. The artery can be felt about the centre of the line mentioned.

Ligature of the occipital artery.

Ligature of the Subclavian Artery.

This operation in the *first part* of the vessel's course has been performed twelve times, but never with success; it is an unscientific as well as unsuccessful operation, and for disease it is scarcely a justifiable proceeding, though for a wound it may perhaps be entertained. The incision for the operation would be similar to that for the innominate.

Ligature of the subclavian artery.

The point usually selected for the application of a ligature to the subclavian is in the *third part* of its course, where the artery emerges from behind the scalenus muscle, and this operation may be demanded for aneurism of the axillary artery or for a wounded vessel.

Place of selection.

Aneurism may affect the subclavian artery in any part of its course; it may involve the whole of the artery, or it may be confined to its first or third portion. When situated on the artery to the inner side of the scaleni muscles, it may be mistaken for an innominate or aortic aneurism, or a common aneurism may involve all these vessels on the right side of the body. When affecting the artery external to the scaleni, it most frequently is associated with disease of the axillary artery.

On subclavian aneurism. Its seat.

The diagnosis of subclavian aneurism is consequently by no means easy; it is thus referred to by Nélaton:

Its diagnosis.

"In subclavian aneurism the tumour extends generally externally to the clavicular origin of the sterno-mastoid muscle, reaching the posterior and inferior triangle of the neck; becomes more elongated transversely than vertically; the bruit is propagated more towards the axilla than the neck, and remains the same on compressing the carotid; the radial pulse enfeebled; the limb painful and œdematous, and incommoded in its movements. In carotid aneurism the tumour is seated between the sternal and clavicular origins of the sterno-mastoid muscle, becomes more elongated in a vertical direction than in a transverse one, and on auscultation gives to the ear a *bruit de souffle*, which is propagated more towards the side of the neck than the arm, with diminution of the arterial pulsation in the corresponding side of the face and cranium, and without weakening the radial pulse on the same side. In innominate aneurism the tumour is placed under the sternum, or at the inner border of the sternal portion of the sterno-mastoid muscle, with weakening of the pulse in the subclavian and carotid arteries, and with absence of the other signs peculiar to the two other forms."

Its prognosis. *The prognosis* must always be regarded as unfavorable, for these aneurisms are peculiarly liable to become diffused, even in the early stage of their development as a visible tumour; yet there are several instances on record of their slow progress, and in some cases fortunate examples of their ultimate cure by natural efforts.

Its treatment. THE TREATMENT of these aneurisms is most unsatisfactory, the space at the disposal of the Surgeon being so limited that he is at a loss to know where he can attack the disease by the few means that are applicable. Ligature. Ligature of the first portion of the subclavian, ligature of the innominate, the distal ligature of the subclavian and axillary arteries, and ligature of the carotid, have all been performed, and, with one exception, have been attended with fatal results. The exceptional case is that of Dr. Smyth, of New Orleans, who tied the innominata and carotid, and subsequently the vertebral artery on the fifty-fourth day. It is only in small aneurisms, occupying the third portion of the artery and the commencement of the axillary, that the operation of tying the subclavian external to the scaleni has been successfully performed, and in some of these instances the outer fibres of the scalenus anticus muscle have been obliged to be divided.

Amputation. *The amputation at the shoulder-joint* on the distal side of the aneurism has been suggested by Surgeons for the cure of the disease. It has been successfully performed by Professor Spence, of Edinburgh.

Galvano-puncture. *Galvano-puncture* has been successful in one case by Abeille; and *escharotics* in another case by Bonnet. Manipulation. *Manipulation* has been employed by Fergusson in two cases, and by Lidell in one case, with satisfactory results in the latter one only. A case of Porter's may also Compression. be accepted as a successful one. *Direct compression* of the aneurism has been tried by Warren, and with a favorable issue, although much danger was risked in the proceeding. Corner's case ('Med.-Chir. Trans.,' vol. lii), although one not actually of the same kind, was a very good instance of the value of protecting an aneurism from enlarging, and exerting such moderate compression as to incite fibrinous deposition in the interior of the sac. Poland's case of successful *pressure on the artery* on the cardiac side of the aneurism is quite an exceptional one. Gay has recently apparently also met with success. Acupressure. The use of *acupressure* by Porter, although successful on the distal side of the aneurism, proved fatal when applied on the cardiac side to the innominate artery, and *injection into the sac* was performed in Injection into sac. one case with fatal result. Langenbeck has recently injected the Hypodermic injection. parts over the aneurism with a *solution of ergotin*, the object being to cause contraction of the aneurismal sac. Such is a list of the means which have been resorted to, but the success has been so poor that the question naturally arises whether we should not discard such measures, and treat these aneurisms on the ordinary principles of internal aneurisms, by rest, attention to diet, &c.

Statistics of the treatment of subclavian aneurism. Mr. Poland, in the 'Guy's Reports' for 1870, in an admirable essay, gives a very favorable return of cases which he has been able to collect in reference to this point. It stands thus:

Out of 13 cases which underwent *general and local treatment* 7 recovered, 1 was relieved, and 5 died; out of 22 cases in which an expectant treatment only was pursued, 4 recovered and 18 died; thus giving a total of 11 recoveries and 23 deaths, 1 being relieved. Of the 23 fatal cases, the duration of life was noticed in 17.

In 21 cases in which the subclavian artery was ligatured in the *third part of its course* for aneurism, 9 recovered (in 6 of these it was the left artery that was ligatured), and 12 died: 8 of the deaths were due to hæmorrhage, and 4 to brain complications or other symptoms. Poland's facts thus accord well with Koch's, who gives 36 recoveries out of 65 cases, something less than half dying, a success which is certainly encouraging to induce Surgeons to undertake the operation.

Ligature of first portion of subclavian.

The operation.—It has been already stated that the application of a ligature to the subclavian in the first part of its course is hardly a justifiable operation; should it be undertaken, the incision on the right side would be similar to that for the innominate, on the left side it is scarcely practicable on account of the depth and relations of the artery.

Ligature of the third portion of the subclavian.

In the *third part* of its course the operation is to be performed as follows, the method being similar for both sides. The patient should be raised upon a pillow, with his head thrown back and face turned to the opposite side, an assistant drawing the arm down as much as possible to depress the shoulder. An incision three or four inches long should then be made on the upper surface of the middle of the clavicle (Fig. 132); not above the bone, as the external jugular vein might then be wounded. Some Surgeons advise the skin to be drawn down from the neck upon the clavicle, so as to diminish this risk. In this incision the skin with the superficial fascia and platysma will be divided. The deep fascia will then be seen with the external jugular vein coursing over it. This must be held aside with a retractor; when its division is a necessity it should be done after the application of two ligatures, one above and another below the line of section. The cervical fascia is then to be divided the whole extent of the wound; this must be done with care on a director; should more room be wanted, a portion of the sterno-mastoid or trapezius muscle may be divided. The knife is now to be laid aside and the artery looked for in the space exposed, the parts being separated by a director or the handle of the scalpel. The vessel will be found just on the outer side of the scalenus anticus muscle, the edge of which can generally be felt, and behind the tubercle on the first rib, a point which can almost always be made out. Several arteries of large size will probably be found crossing this space, and many veins. The supra-scapular artery and vein will always be seen behind the clavicle. The brachial plexus lies external to and behind the subclavian artery, the subclavian vein in front and below. When the vessel is seen or felt the sheath is to be opened and the aneurism needle passed around it, from below upwards, care being taken not to injure the vein or include a nerve.

Ligature of the Axillary Artery.

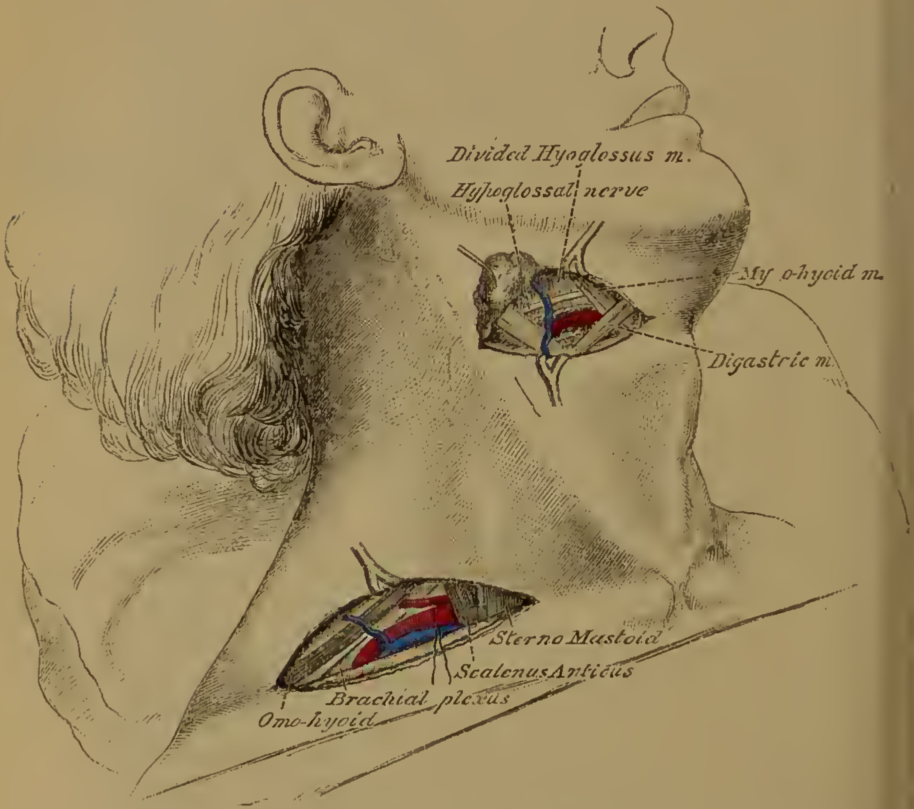
Ligature of the axillary artery.

This is a rare operation, although it may be demanded for some wound of the vessel or aneurism of the brachial. It may be performed in two positions, either below the clavicle or in the axilla.

The subclavicular operation.

The subclavicular operation is carried out by an incision made immediately below the bone from the coracoid process to its sternal end, dividing integument and fascia, but carefully avoiding the cephalic vein that runs along the anterior border of the deltoid to join the axillary. The clavicular origin of the pectoral muscle may then be divided and

FIG. 132.



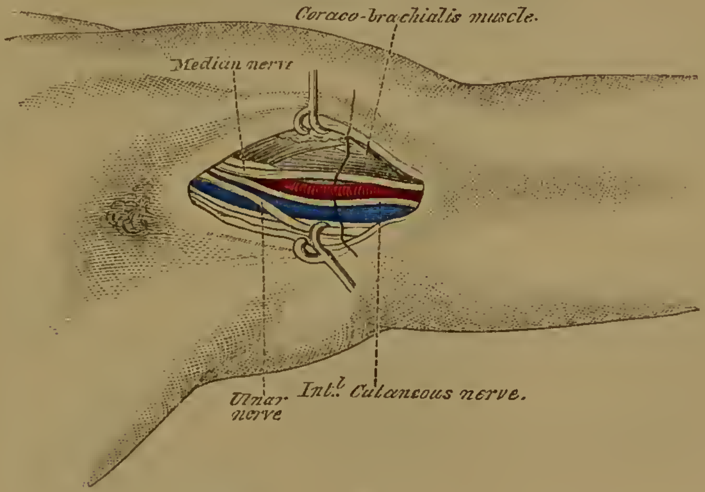
Ligature of subclavian and lingual arteries.

the deep fascia or costo-coracoid membrane covering in the sheaths of the vessels exposed. In this step of the operation some of the branches of the thoracic acromial artery will come into view, and if wounded must be secured. The coracoid insertion of the pectoralis minor may also be seen. The fascia covering in the vessels will then be exposed, and on laying it open the greatest care is needed, for the axillary vein lies immediately beneath it, and above this will be found the vessel resting on the first intercostal muscle. The brachial plexus is above and behind. The axillary vein must be drawn downwards and the aneurism needle passed from below upwards, care being observed not to include the external respiratory nerve of Bell that passes behind the artery. When the vessel has been exposed the passage of the ligature will be facilitated by bringing the arm down to the side of the body. On the dead subject this operation is not difficult, but the number of veins and arteries that exist in the space must render the operation on the living far from easy.

Ligature of the artery in the axilla.

To tie the axillary artery in the axilla, the arm should be well raised upwards, and the course of the vessel marked out slightly posterior to the middle line of the axilla. An incision should then be made along the inner margin of the coraco-brachialis muscle through the skin and fascia for about two or three inches, and the deep fascia exposed. These should be carefully divided to the whole extent of the wound, when the artery with its attendant nerves and veins will come into view. In this stage of the operation the forearm should be flexed on the arm to relax the parts. The vessel, as a rule, has the median nerve on its outer side, between it and the coraco-brachialis muscle, and the vein and ulnar nerve within. The internal cutaneous nerve is in front. (*Vide* fig. 133.)

FIG. 133.



Ligature of axillary artery.

Guthrie's opinion.

Mr. Guthrie condemned the subclavicular operation altogether, and advised the Surgeon to expose the artery by an incision three inches long carried upwards along its course, commencing at the lower border of the pectoral muscle; but few Surgeons have followed this advice, most men preferring the operation named subclavicular, one of its modifications, or the ligature of the subclavian. Mr. Erichsen prefers for the superior operation an incision made from the centre of the clavicle downwards in the course of the vessel to the middle of the anterior fold of the axilla, this incision necessitating the division of the great pectoral muscle, and often of the small. He says that this division need not leave any permanent weakness of the limb, as by proper position ready union may be effected between the parts.

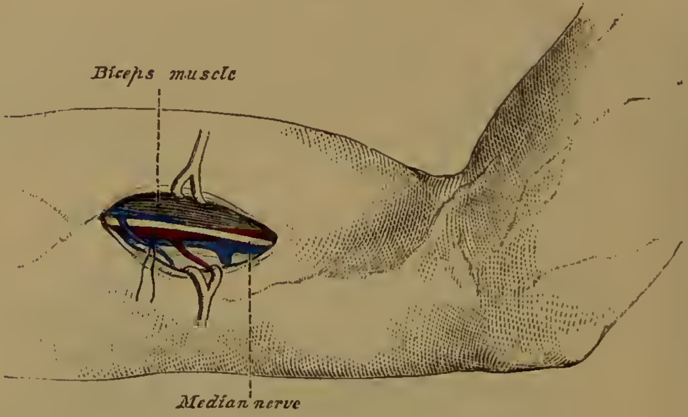
Erichsen's views.

In all these operations on the axillary artery the Surgeon must be on the look out for abnormal division and relations of the vessel.

Ligature of the brachial artery.

Ligature of the brachial artery may be demanded for direct injury to the vessel, hæmorrhage from a wound of one of its divisions in the hand or forearm which cannot be treated locally, aneurism, &c., and it may be performed readily in any part of its course. The middle of the arm is the best point to choose. The course of the vessel is indicated by a line drawn from the middle of the axilla to the inner side of the biceps tendon at the bend of the elbow, and the inner border

Fig. 134.

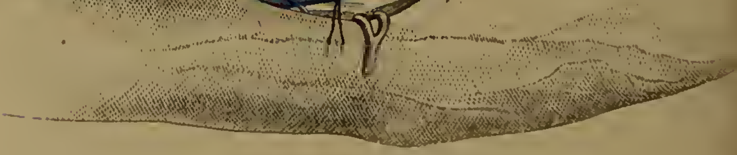


Ligature of brachial artery.

Description of the operation.

of the biceps muscle is the guide to the incision. The vessel may be exposed by a cut two to three inches long made in this position, with the arm extended and supinated. The skin, which is always thin, and the fascia, should be carefully divided, and the deep fascia exposed. This is next to be laid open, but with care, for the basilic vein lies immediately below it, on the inner side of the brachial artery. The ulnar nerve will be found on the inner side of the vein, and the median in front of the artery, but there is no regularity in these relations; much care is consequently required in finding the vessel,

Fig. 135.



Ligature of brachial artery.

and discretion in tying it, for a high division of the vessel or the existence of some vas aberrans may mislead and confuse. When the right vessel has been found the application of a ligature is readily concluded. In performing this operation the Surgeon must be careful not to open the sheath of the biceps muscle, and he should remember to flex the forearm on the arm after the division of the deep fascia has taken place.

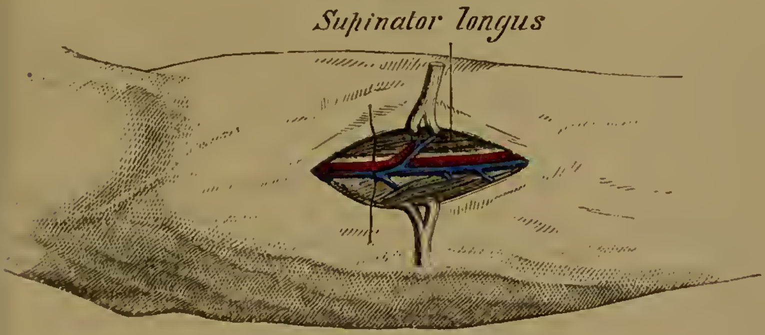
Ligature of the lower third.

Ligature of the brachial in its lower third is now rarely performed; in the days of bleeding it was by no means infrequently required for traumatic aneurism, but it has never fallen to my lot to witness its performance for such a cause. The operation may be performed with the forearm extended, by making an incision two and a half inches long on the inner side of the tendon of the biceps, care being taken to avoid the large veins that ramify in the superficial fascia. The tendinous aponeurosis of the biceps will then come into view, and on its division the artery will be exposed with its venæ comites, the tendon of the biceps being on its outer and the median nerve on its inner side. The forearm should then be flexed after the artery has been exposed, when a ligature can be passed without trouble.

Ligature of the radial artery.

Ligature of the radial artery.—A line drawn from the *outer* side of the biceps tendon at the bend of the elbow to half an inch internal to the styloid process of the radius at the wrist, marks out with sufficient clearness the course of the radial artery, and the vessel may be tied in any part of it. In the upper third of the forearm (Fig. 136), between the supinator longus on the outer and pronator teres on the inner side, it may be found by an incision two inches long made in the line above mentioned, dividing the integument and deep fascia, care being taken not to divide the large cutaneous veins unnecessarily; on separating the muscles with the handle of the knife, the forearm being partially flexed, the artery will be brought into view with its venæ comites, the nerve being to its outer side. A ligature will then be readily passed round the vessel. I have had to cut down upon the radial artery in this part of its course for a traumatic aneurism the result of a punctured wound, when I divided the vessel and twisted both ends, a speedy convalescence following.

FIG. 136.

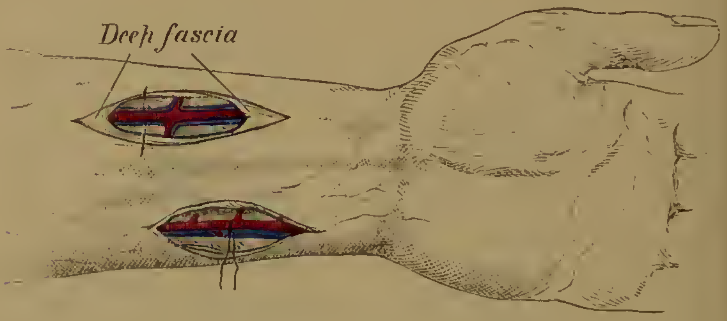


Ligature of radial artery.

At its lower third.

At the lower third the vessel is to be found external to the flexor carpi radialis muscle, but internal to the supinator longus; it lies beneath the deep fascia, and on the division of this the artery can readily be found (Fig. 137). On the dead subject the principal cause of difficulty in applying the ligature lies in the fact that students look for the artery too superficially, mistaking the superficial radial vein for the deep. I have had to ligature or twist the radial above the wrist on seven occasions for aneurism; in six for traumatic aneurism situated in front of the wrist, and in the other for aneurism on its dorsal end. In all a good result ensued.

FIG. 137.



Ligature of the ulnar artery.

Ligature of the ulnar artery.—This vessel lies beneath the superficial layer of muscles in the upper half of its course, and in the lower it is to be found between the tendons of the flexor carpi ulnaris on the inner side and flexor sublimis digitorum on the outer, being covered in with integument and deep fascia. Its position is roughly indicated by a line drawn from the inner side of the biceps tendon to the radial side of the pisiform bone, the upper part of the vessel describing a curve with the concavity outwards.

To ligature the artery in the upper half of its course an oblique incision should be made, crossing the line above indicated, and the radial border of the flexor carpi ulnaris should be found. Through this the incision must be made, when the artery will be seen between the two layers of muscles. This operation is a very difficult and uncertain one, and it is an open question whether it is a sound one. I am disposed to think that the brachial had better be tied under all circumstances rather than have recourse to it.

To tie the ulnar above the wrist is not more difficult than to tie the radial (Fig. 137). An incision along the outer side of the flexor carpi ulnaris, dividing skin, superficial and *deep* fascia, will expose the vessel, with its venæ comites, and the nerve on its inner side. A ligature is easily passed round it. The drawings well illustrate these points.

Hæmorrhage from the palm of the hand, and its treatment.

Hæmorrhage from the palm of the hand is always alarming and troublesome, more particularly from a punctured wound. In a superficial incised wound the vessel may generally be found and ligatured or twisted, but in the case of a deep wound it is neither expedient nor justifiable to cut into and explore the palm for the purpose.

When the vessel cannot be tied, therefore, a graduated compress may be applied over the wound, and the fingers flexed and bound down over a ball or block of wood, the arm being well raised in a vertical position, and this dressing should not be undone for at least five or six days. Should these means fail, which they rarely do when efficiently employed, the radial and ulnar arteries may be compressed with acupressure needles, and should this not succeed, the application of a ligature to the brachial artery may be called for. In neglected cases, where the parts are all infiltrated and boggy, this practice may be called for at once. It would be well, however, before resorting to this practice, under all circumstances, to try extreme flexion of the forearm upon the arm, with forced supination of the hand, with or without a pad at the bend of the arm; for it is now well known that by this position the circulation through the brachial artery can be completely arrested; indeed, under all circumstances, whether for injury or disease of the arteries of the hand and forearm in which surgical interference is called for, it would be well to bear this treatment in mind; it is most effective. It is well to know, however, that repeated hæmorrhage may take place from the palm of the hand from the presence of a sloughing tendon. I may mention in illustration a very interesting case I had with Dr. Bunny, of Newbury, in which a gentleman, æt. 33, had his middle finger bent back so forcibly by a cricket ball as to cause rupture of the integument in front of the extreme joint, and laceration of the flexor tendons of the finger about the wrist. Suppuration and sloughing of the tendons followed, attended by repeated attacks of palmar hæmorrhage, which ceased at once on the removal of the dead tendons.

Ligature of Arteries of the Lower Extremity.

Ligature of the External Iliac Artery.

Ligature of the external iliac artery.

This operation may be required for aneurism of the common femoral for wound, or for any other cause in which it is necessary to arrest the flow of blood through the lower extremity. It should not, however, be performed for any disease unless pressure of the artery, digital or instrumental, has proved ineffectual or is inapplicable, for Mapother ('Dub. Med. Press,' 1865), Eck ('St. Barthol. Hosp. Rep.,' 1866), and Hilton ('Med.-Chir. Trans.,' 1869) have all recorded instances of cure of inguinal aneurism by these means. The operation of ligature is, however, a successful one; Norris and Cutter give forty-seven fatal cases out of 153 ('Am. Jour. Med. Sci.,' 1847 and 1864). I have performed it on four occasions, and in all with success. The course of the vessel is clearly indicated by a line drawn from the left side of the navel, where the aorta bifurcates, to the middle of Poupart's ligament, the upper third of this line corresponding to the common iliac, and the lower two thirds to the external.

When applicable.

Statistics of the operation.

Course of vessel.

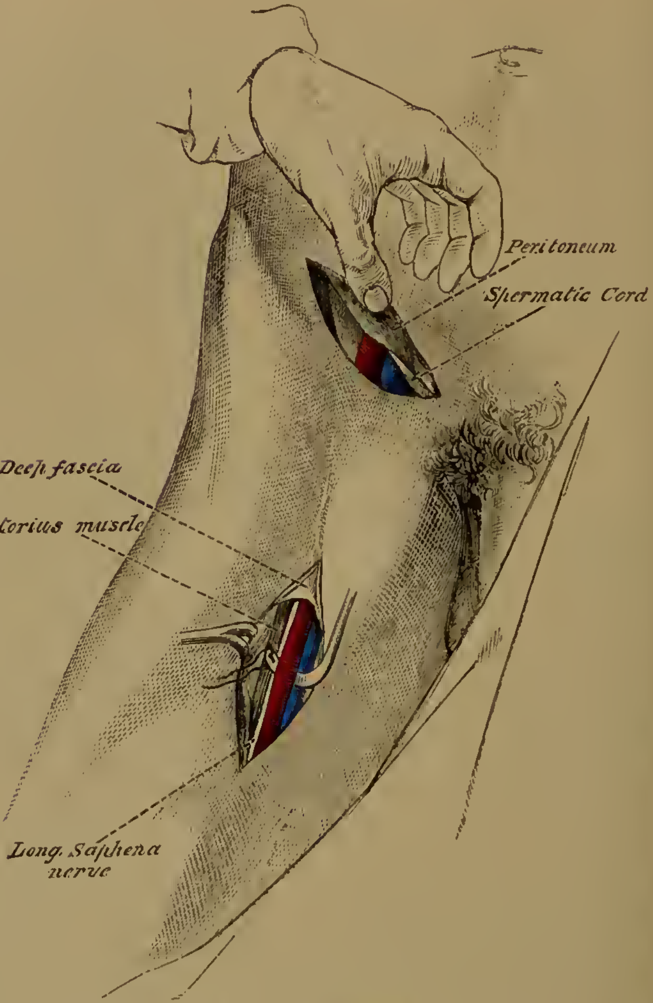
Abernethy, in 1796, was the first to ligature the vessel, and the incision he adopted was a vertical one in the course of the artery, beginning an inch above Poupart's ligament. The peritoneum is, however, too much disturbed by this proceeding, and the abdominal walls weakened. The best incision is the one employed by Sir A. Cooper, a slightly curved one, about half an inch above Poupart's ligament, and to the inner side of its centre, curving upwards and outwards for about three inches towards the anterior superior spine of the ilium. (Fig. 138.) This incision should divide all the soft parts superficial to the external oblique muscle. All vessels that are divided should be secured.

Abernethy's operation.

Modern incision, and description of the operation.

The tendon of the external oblique muscle should then be divided the whole length of the skin wound, together with the internal oblique and transversalis muscle, when they cannot be drawn outwards, care being taken not to injure the peritoneum; the cord which may now come into view should be drawn inwards, and the parts held well aside by hooked retractors. With the fingers the transversalis fascia is to be torn through from Poupart's ligament, the peritoneum raised

FIG. 138.



Ligature of external iliac and superficial femoral arteries.

upwards, and the sheath of the vessel exposed, the vein being to the inner side of the artery; by means of a director and forceps the sheath can readily be opened and a ligature passed, the needle being introduced between the vein and artery. To divide the transversalis fascia the whole length of the wound is an unnecessary and dangerous proceeding; to leave it as suggested above is an extra protection to the peritoneum, and in no way renders the operation more difficult; indeed, I have been led to believe that it facilitates the operation; it certainly does upon the dead subject, and in the four cases in which I have been called upon to perform it on the living this opinion was confirmed. The genito-crural nerve, which lies upon the vessel, should not be included in the ligature. This operation is, however, only applicable for tumours situated below Poupart's ligament; for others, Abernethy's operation, or that suggested for the common iliac, should be chosen.

Ligature of the common iliac.

Ligature of the common iliac artery has been performed about thirty-nine times, and ten times with success. It was first successfully performed by Mott, of New York, in 1827. I have seen it done but once, by my colleague Mr. Cock in 1863, on a man æt. 27, and with success.

To expose the vessel the incision must be a long one, its length being determined by the size of the aneurism, and depth of the artery. A curved incision commencing outside the internal ring and passing upwards and outwards as far as the external iliac artery appears to be the best, the muscles being divided to an equal extent. The transversalis fascia must be laid open or torn through, and the peritoneum turned upwards. It is at this part of the operation that the greatest difficulties arise, for as soon as the transversalis fascia is divided the peritoneum covering the intestine bulges into the wound. This membrane also is frequently adherent to the aneurismal sac, and much difficulty is felt in separating it. This was markedly so in Mr. Cock's case. The oozing of blood also into the wound masks the vessel. The depth of the wound, likewise, renders the application of the ligature a matter of great difficulty. Nevertheless, these difficulties are to be overcome by care and good aids. The operation is very similar to that last described, but more difficult. In 1846 Mr. Stanley ligatured the common iliac artery by an operation as suggested by Sir P. Crampton, and described by Skey. The patient was placed upon his side and an incision made from the end of the last rib downwards and forwards in front of the iliac crest. The transversalis fascia was divided, and the peritoneum rolled up. The common iliac artery was found and tied with apparent facility. Upon the dead body this operation is far from difficult, and promises to be of use in the living when the aneurismal tumour is large and high up. Indeed it is probably the better operation of the two given. The abdominal aorta might be ligatured by the same means. (Fig. 130, page 449.)

Crampton's operation.

Ligature of the internal iliac.

Ligature of the internal iliac.—Stevens, of Vera Cruz, in 1812, was the first to perform this operation, in a case of gluteal aneurism, occurring in a negress, and the operation proved successful. Since his time the operation has been repeated eleven times, and in six cases with success. The incision and steps of the operation are the same as for the common iliac. Stevens, however, cut down through the anterior abdominal walls, as in Abernethy's operation for the external iliac. The operation should not, however, be performed for gluteal aneurisms unless rapidly increasing, till other means of cure have been tried and failed, such as pressure upon the outer or common iliac, or even galvano-puncture; and Holmes has fairly shown, in his College lectures, that in cases of imperfect or ruptured sacs either the operation of Anel or that in which the sac itself is opened should be practised.

In operating upon any of the iliac vessels the Surgeon should remember that great variety exists as to their length, &c. When the common iliac is long, its branches will be short, and *vice versâ*.

Ligature of the Femoral Artery.

Ligature of the femoral.

This vessel may be tied in any part of its course, and when the thigh is straight a line drawn from the centre of Poupart's ligament to the centre of the popliteal space will mark out its position with tolerable accuracy. When the thigh is abducted and rotated outwards a line drawn from the same point above to the inner edge of the patella will indicate the upper half of its course. In the upper third it is tolerably superficial; in the middle it is covered in by the Sartorius muscle, which varies much in its width, and in the lower third it lies in Hunter's canal. At the present day it is an exceptional act to ligature the vessel in Hunter's canal; for popliteal aneurism, the artery is generally ligatured in the middle third of its course at the apex of Scarpa's triangle. For aneurism of the femoral itself the common femoral may be tied below Poupart's ligament.

Place of election.

Operation on the common femoral.

The **Common Femoral** is usually about one inch and a half in length, but in one case in four it does not exceed one inch; in one in four it is between one inch and a half and two inches. (Nnnn.) It is from these facts that Surgeons have generally preferred to ligature the external iliac rather than the common femoral. The two Porters, however, and Macnamara, of Dublin, have brought forward sufficient evidence to prove that good success may attend the practice, giving thirteen cases between them, eleven proving successful. On the other hand Erichsen tells us that out of twelve cases on record, three only succeeded, evidently having overlooked the Dublin cases. He gives it also as his opinion that the operation "ought to be banished from surgery." In this opinion I cannot agree, after a careful perusal of the Dublin cases in the 'Dublin Quart. Journ.,' 1860, and 'Brit. Med. Journ.,' Oct., 1867.

The operation is, moreover, a very simple one; the vessel being readily exposed by a vertical, oblique, or transverse (Porter's) incision. The sheath of the artery can be opened without touching the vein,—indeed the vein should never be exposed,—and a ligature passed, care being taken not to enclose the crural branch of the genito-crural nerve that runs down in front of the vessel.

Objections to the operation.

The main arguments against the operation are founded on the uncertain length of the artery, the proximity of the ligature to large branches, and the liability to gangrene from the occlusion of the main nutrient arteries of the limb. On the other hand there is the success of the operation, and the facility with which it can be performed. More experience is, however, required before the question can be decided. It should not be dismissed without due consideration.

Ligature of the middle third of the femoral.

Ligature of the femoral artery in the middle third of its course is a capital operation, and, moreover, a successful one. Norris gives 46 fatal cases out of 188 operations for aneurism collected from all sources, or one fourth from John Hunter's first operation in 1785 down to 1848, and undertaken under many different conditions. Syme tells us that he has had 23 successful cases consecutively, and at Guy's Hospital during fourteen years the femoral artery was tied for aneurism 24 times, with only 1 death (from pyæmia), and one failure; these cases including 6 cases in which pressure had been tried and failed. Pressure had been employed in 17 cases, and in 11 with success. Mr. Holmes, in his lectures at the Royal College of Surgeons in 1874, however, gives some statistics of recent hospital practice, which possibly places the operation in even a better light, for out of 77 cases of popliteal aneurism

Statistics of the operation.

treated by ligature at once, the deaths were 11, or 14 per cent., and the failures 15, or 19 per cent.; and in 44 other cases in which the ligature was applied after the treatment by pressure had failed, 31 succeeded and 13 failed, or 29 per cent., the mortality in the latter class of cases, as might have been expected, being larger than in the former.

I may add, that of 124 cases of popliteal aneurism collected by Mr. Holmes, pressure succeeded in 66, and failed in 58. In 44 of the 58 cases the artery was tied, as seen above, 13 of these cases dying; of the remaining 14 amputation was practised in 8, death occurred in 1, and in 4 there is no evidence of subsequent treatment.

The operation.

Description of the operation.

To tie the vessel the limb of the patient should be slightly abducted and rotated outwards; the leg being partially flexed and the knee supported on a pillow. The line of the vessel should then be marked by the eye, and the point at which the ligature is to be applied determined, the lower part of Scarpa's triangle being the "point of selection." (Fig. 138.) An incision about three inches in length should then be made parallel to the vessel, dividing the integument and superficial fascia down to the deep parts; the course of the superficial veins having been previously ascertained by making pressure upon the saphena vein where it joins the deep femoral, in order to avoid it. Should the vein be in the way, the incision may be made by its side, but it is generally to the inner side of the wound. The deep fascia may next be divided, and the *inner* border of the main guide to the artery, the Sartorius muscle, looked for. This is readily to be recognised by the course of its fibres *downwards* and *inwards*, and beneath this the sheath of the vessel is surely to be found. The muscle having been gently separated from its attachments by means of the finger, and held outwards with a retractor, the sheath will be exposed with the artery in front and vein behind, a nerve generally lying upon the vessel. The sheath must then be opened with caution, and its inner side held tense, an opening being made sufficient to expose the vessel and admit the aneurism needle; care should be taken to keep the end of the needle close to the artery, in order that the vein may not be injured or included in the ligature. The needle had better be passed from within outwards. The ligature having been passed, the Surgeon must satisfy himself that nothing but the artery is surrounded, and that the right vessel has been exposed; he may then tie it, readjust the parts, and close the wound, covering the limb with cotton wool and raising it on a pillow. Should the vein be wounded by the needle the artery must not be tied at the point corresponding to the wound, but about an inch higher or lower, for "the thread would be left in the vein to act as a seton, and phlebitis could hardly fail to ensue, and would most likely prove fatal." (Holmes.)

Method to be pursued when vein wounded.

A ligature may separate from the femoral artery in nine or ten days, or may fail to do so for even thirty, a wide difference existing on this point. An analysis of cases fairly proves that no general rule can be laid down when its separation may be expected.

Ligature of the Popliteal Artery.

Ligature of popliteal.

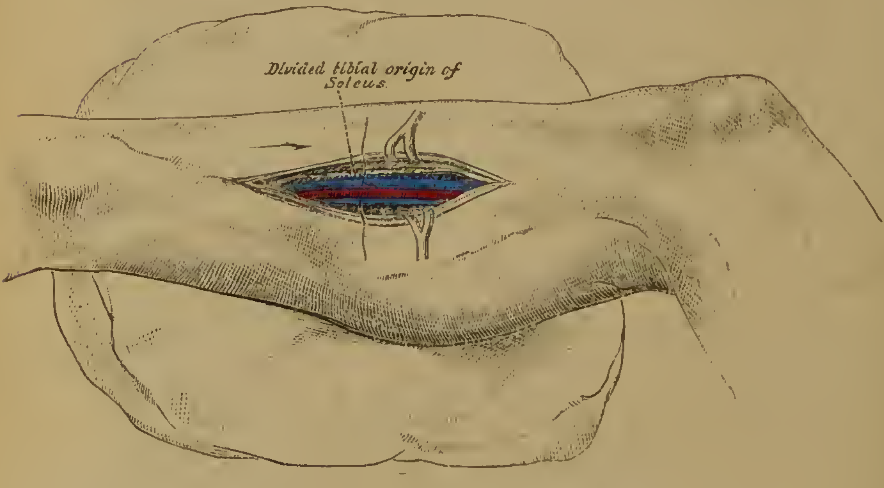
I hardly know under what circumstances the *popliteal artery* may require the application of a ligature; for a wound it may, perhaps, be required, but for rupture the operation is as inapplicable as it would be unsuccessful. Mr. Poland has pointed out how the posterior ligament of the knee-joint is frequently involved in the laceration of the vessel. For aneurism the operation is never likely to be required. Some years ago I was called upon to cut down upon a large needle that had perforated the popliteal space, and had become lost in its tissues; all movements of the joint having been rendered impossible by the pricking pain of its presence. I found the foreign body lying obliquely across the popliteal artery with its point fixed in the posterior ligament of the knee-joint. The artery was exposed without difficulty by an incision made along the outer edge of the semi-membranosus muscle, the leg being extended. The vein is always to be found to its outer side, and more superficial, the nerve is still further out.

Ligature of the posterior tibial. Guthrie's practice.

Ligature of the Posterior Tibial Artery.

Guthrie brought the weight of his great authority to support the recognised practice of tying a wounded vessel at the wounded part, even in the case of the deeply placed posterior tibial and peroneal arteries, and carried it out practically in a supposed wound of the latter vessel by making a free incision through the muscles of the calf of the leg down to the wounded artery. Arnott, also, acting on Guthrie's suggestion, tied the posterior tibial by this method, but neither the report of the case ('Med.-Chir. Trans.,' vol. xxix), nor Mr. Arnott's remarks, are in any way encouraging in favour of its repetition; in fact, modern Surgeons have universally rejected the method in favour of the one now to be described.

Fig. 139.



Ligature of posterior tibial artery.

It must be premised that the vessel lies beneath the superficial layer of muscles forming the calf and beneath the deep fascia, the nerve being to its outer side; its course is indicated by a line drawn from the centre of the popliteal space to a point midway between the inner malleolus and the tendo Achillis.

To tie the artery the leg must be partially flexed upon the thigh and made to rest upon a pillow on its outer side, the heel being raised to relax the muscles. An incision about four inches in length is then to be made about half an inch from the edge of the tibia, and parallel with it, through the integument, down to the deep fascia, any large superficial veins being avoided where possible. The deep fascia may then be divided and the muscles exposed. The lower border of the tibial origin of the soleus muscle should then be looked for, and a director introduced beneath it, the tibial origin of this muscle being divided the whole extent of the wound. The glistening tendinous covering of the deep surface of the muscle is a good guide to the vessel, and it is not to be mistaken here for the deep fascia which lies deeper, and beneath which is the vessel. To search for the artery the leg may be well flexed, the heel drawn up, and the muscles retracted. The ligature may be passed in the most convenient way.

Operation on the artery in the middle of the leg.

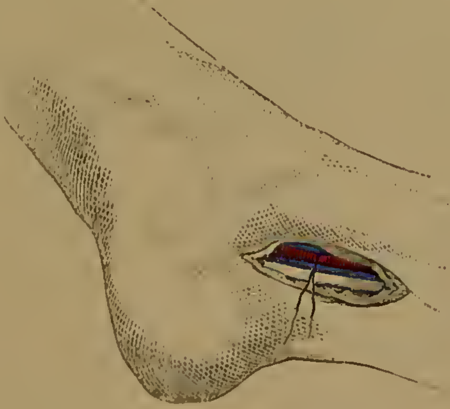
Upon the dead subject this operation is not a difficult one, and upon the living it can hardly be so "difficult, tedious, bloody, and dangerous" as Mr. Guthrie has described it, and as his own operation certainly is.

The operator, however, should be careful not to divide the tibial origin of the soleus too near the tibia, as in doing so he may get too deep beneath the deep fascia, and thus lose his best guide, the glistening tendinous tibial origin of the soleus.

To tie the artery at the *lower third of the leg behind the inner malleolus* is a simple operation. It lies with its venæ comites at the junction of the anterior with the middle third of the space between the malleolus and the heel, the nerve being behind. It can be readily exposed by a curved incision two inches long made in its course dividing integument, and *deep* fascia, which latter is thick from receiving many fibres from the internal lateral ligament. The relative position of the vessel is easily seen in the drawing (Fig. 140).

Operation on the artery behind the malleolus.

FIG. 140.



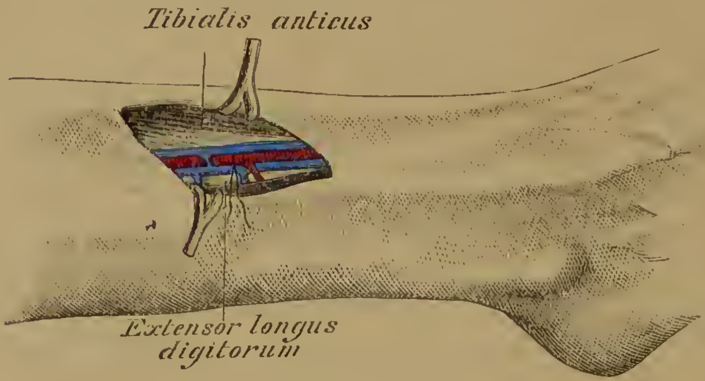
Ligature of posterior tibial artery behind inner malleolus.

Ligature of the anterior tibial.

Ligature of the Anterior Tibial Artery.

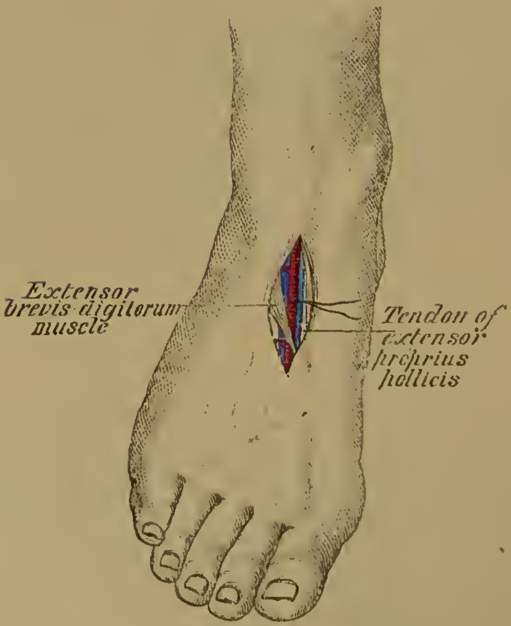
This operation is far from simple, as the vessel lies buried in the upper two thirds of its course between the muscles on the interosseous membrane; its course is indicated by a line drawn from the inner side of the head of the fibula to the base of the great toe, and the surgical guide to the vessel is the tibialis anticus muscle, which *lies to its inner side* throughout its course.

FIG. 141.



Ligature of the anterior tibial artery.

FIG. 142.


Extensor brevis digitorum muscle
Tendon of extensor proprius pollicis

Ligature of dorsalis pedis artery.

Mode of reaching the vessel.

To reach the vessel in the upper two thirds of its course it is consequently important to expose the intermuscular space separating this tibial muscle from its neighbours, and the best way to do this is to make an oblique incision four inches long, commencing at the outer edge of the tibia and directed downwards and outwards towards the external malleolus, dividing the integument and superficial fascia. The deep fascia will then be exposed, and the first white line external to the tibia will be found to mark the intermuscular space outside the tibialis anticus muscle in which the anterior tibial artery is to be found. The fascia over this line is then to be opened, and the muscles are to be separated, the foot being well flexed to facilitate this measure. The anterior tibial nerve will now come into view, and beneath this the artery will be found. The ligature may be passed as the Surgeon best can.

Ligature of the dorsalis pedis artery.

The dorsalis pedis artery is to be ligatured to the outer side of the extensor proprius pollicis muscle, along which it lies. It is readily exposed by an incision made along its course, the integument and *deep* fascia being divided. (Fig. 142.) The vessel is crossed at its lower part by the tendon of the extensor brevis digitorum muscle. The nerve lies outside the vessel, and venæ comites attend the artery. The tendon of the last-named muscle is an infallible guide to the artery, as it crosses it, whilst the tendon of the extensor proprius pollicis muscle is the guide to the incision.

CHAPTER XI.

INJURIES AND DISEASES OF THE VEINS.

Wounds of veins.

The blood from a wounded vein is black, and flows in a steady stream, it never jets out as from an artery. When mixed with arterial blood, as occurs when both artery and vein are punctured, it may appear as a dark band streaming through a red one, or *vice versâ ;* the relative thickness of the black or red band indicating the extent of the wound in the artery and vein. Pressure on the distal side of a wounded vein controls bleeding, whilst pressure on the cardiac side increases it.

Mode of union.

Wounds of veins unite in the same way as wounds of arteries, the reparative process being alike in both; after a clean incision into a vein repair may in a few days be so perfect as to leave no trace of injury behind. The lips of a vein wound readily unite when kept together by gentle pressure, as after venesection, or the application of a ligature.

Complete division.

A completely divided vein contracts, although less than an artery; it *retracts* also into its sheath, and the natural arrest of hæmorrhage from a vein is helped by these actions, together with the coagulation of the blood in the vein and around its orifice. But these processes are slow in their action, very feeble, and practically insufficient. Fortunately, however, hæmorrhage from a divided vein is readily arrested by well-adjusted pressure and by elevation of the limb. In amputations, should venous bleeding persist after the removal of pressure from the limb above the wound, and should the means just indicated have failed, the bleeding vein may be acupressed, ligatured, or, what is better, twisted, to stop it; bad results rarely taking place. When deep veins of large size are divided and cannot be treated a fatal result rapidly ensues.

Partial division.

A partially divided vein often gives much trouble, although not when *superficial*, for the elevation of the limb, and a compress carefully strapped or bandaged over the wounded part are generally sufficient to check the bleeding, and in three or four days repair may be expected, the pressure in no way interfering with this process.

Wounds of deep veins.

Wounds of deep veins are, however, of grave importance, for they may be so placed that pressure cannot be applied, or bleeding may be so profuse as to cause speedy death; or, again, unhealthy inflammation of the vein may follow, with all its dangers.

Treatment. Pressure.

In wounds of any of the veins of the extremities well-applied pressure is as a rule sufficient to arrest bleeding, and give time for repair, Ligature.

although when the trunk of the femoral vein is wounded in operation, as in ligature of the femoral artery, the opening in the vein may be taken up when it is in view with a pair of forceps and tied with a fine silk ligature; and the same should be done with a punctured wound of the internal jugular, or any large vein. When this practice cannot be adopted the whole vein must be tied. Wounded veins, indeed, may be treated on the same principles as wounded arteries; when pressure is enough to arrest hæmorrhage from a vein, however large, the ligature is not required; when it fails, or is inapplicable, the ligature may be fearlessly employed. The dread of setting up phlebitis by interfering with the veins is based on prejudice and not on experience; it is doubtless due to the influence of the authority of great names who have pronounced against it. It is not, however, to be disputed that phlebitis occasionally follows the surgical treatment of veins, but it occurs as often as not independently of it. When it occurs it is a serious affection. It takes place, however, only in the enfeebled and cachectic.

Wounds of internal jugular and subclavian veins.

Wounds of the *internal jugular and subclavian veins* are as fatal as wounds of the carotid or subclavian arteries, indeed probably more so. When the internal jugular is wounded near the base of the skull life is speedily destroyed, and when near its cardiac end, to the danger of hæmorrhage is added that of the introduction of air into the heart. When the internal jugular is divided above the clavicle, the orifice remains open; the walls of the vein not collapsing, as they would at a greater distance, owing to their connections with the deep cervical fascia; reflux bleeding consequently takes place from the cardiac end, and during some violent inspiratory act air may be drawn into the circulation and into the heart, causing death. Thus great care is always required in operating about the root of the neck to avoid large veins, and to compress or ligature them when wounded.

When death takes place from primary hæmorrhage from the internal jugular it is generally within an hour. I recorded in the 'Trans. of Path. Soc.' in 1857 such a case which occurred in the practice of Mr. Birkett, Mr. Henry Gray recorded a second in 'Holmes's Surgery,' and Mr. Samuel Cooper a third in his 'First Lines of Surgery.'

When death does not take place from either of the above two causes it may occur from secondary hæmorrhage or from pyæmia.

A vertical incision into the internal jugular vein is not necessarily attended with a fatal hæmorrhage. When it occurs, the bleeding will be recurrent. This was well illustrated in a case recorded by Mr. Woodman, of Exeter ('Brit. Med. Jour.,' 1873), and in which the internal jugular vein was ligatured with a successful result.

Coagulation in veins. Adhesive phlebitis. Indications.

Coagulation in veins.

Adhesive phlebitis.—When a vein was found by the older Surgeons obstructed by a fibrinous clot, the suspicion of phlebitis was excited, and when this clot contained in its centre a "puriform" fluid, the evidence of inflammatory action was considered to be strong. When the clot was more or less adherent to the inner membrane of the vein, and this membrane presented a pink appearance, the evidence was thought to be complete. At the present day, however, none of these phenomena are accepted as true indications of an inflamed vein; for it is known that blood coagulates spontaneously in a wounded, lacerated, or bruised vein, from prolonged pressure upon its walls, or inflammatory changes in the parts around, and that even in ill-nourished

Evidences of an inflamed vein difficult to determine.

and cachectic subjects there is a remarkable tendency for the fibrin of the blood to become deposited upon the serous lining of the veins, either idiopathically, from some altered condition of the blood, or upon the slightest injury, without the existence of inflammatory action.

Supposed pus in clot.

The supposed pus found in the centre of the fibrinous mass is known to be made up of the white blood-corpuscles present in all coagula, and the pinkish tint upon the serous lining of the vein is due to the mere imbibition of colouring matter from the blood, and not to inflammatory injection.

Tendency of clot to increase rapidly.

Thrombosis.

Thickened coats not real.

Clots may not obstruct entirely.

Clot may soften and disintegrate and escape into circulation.

Example.

A clot once formed in a vein rapidly increases, the stream of blood as it flows over it depositing fresh layers, until the whole calibre of the vein is obstructed; when the process is slow regular layers of fibrin may be seen in section, when rapid the clotting is irregular. At the extremities of the clot, also, like accretions are deposited; the coagula increasing more or less rapidly in all directions, and into all branches, till complete obstruction, or THROMBOSIS, takes place. This clotting of blood in the vein becomes arrested only by the blood stream of a junction trunk. These coagula can readily be removed by washing, and when removed the lining membrane of the vein will generally be found natural, and the valves visible. The coat of the veins at times may appear thickened from contraction, but Mr. Callender has shown this condition to be not real but only apparent, the coats of the veins readily yielding to pressure under water. In the process of cure sometimes the clot will contract towards one side of the vein, and thus allow the blood to pass and the circulation to become re-established. In rarer cases the blood "may drill for itself a passage through the centre of the clot." More commonly, however, a different result takes place, the vein becomes permanently obliterated, the clot and vein ultimately contracting so as to form a firm and shrunken cord. In rare cases the clot may subsequently organize. Authors have described these cases as instances of *adhesive phlebitis.* In feeble and cachectic subjects, however, these curative changes will not take place. The clot instead of organizing will soften and disintegrate, giving place to blood-stained puriform fluid, that may be carried into the circulation through the heart into the lungs, and set up a lobular pneumonia, such as is found in pyæmia from embolism of the pulmonary artery. This was well illustrated in the following case, extracted from the catalogue of the Guy's Museum, No. 1521^{55}. Jugular vein exhibiting a wound occupying about half its circumference, and situated about half an inch above the subclavian, the neighbouring branches showing the effects of phlebitis. James F—, æt. 30, under Mr. Birkett. He received a stab with a knife in the left side of the neck by which the jugular vein was wounded; much hæmorrhage followed, and continued for some days, when symptoms of phlebitis set in, and he died of pneumonia twenty days after the accident. The vein was found wounded as seen in the preparation, its coats infiltrated with lymph, and its interior filled with fibrin. The lungs were filled with abscesses.

Results such as these do not, however, occur under all circumstances, they do so only in the feeble and cachectic, for "the clot when softened is usually shut off in an upward and downward direction by newly added coagula. The softening begins in the coagula last formed, and not, as Virchow states, in those first deposited, for in the advance of the malady the patient's health fails, and the fibrin becomes more and more prone to disintegrate and soften into a puriform fluid." (Callender.) The clot, moreover, softens in the centre and not at its periphery. These cases have been described as examples of *suppurative phlebitis.*

Symptoms of an obstructed vein.

Symptoms.—The most prominent symptom of an obstructed vein is œdema of the parts below the obstruction, some fulness of the superficial veins, local pain and tenderness, with constitutional disturbance of variable degrees of severity generally preceding. When superficial veins are involved the symptoms may be chiefly local, but in the case of the deep veins constitutional disturbance is sure to accompany local action. Amongst the superficial veins the saphena of the leg and thigh is most commonly affected, and it is often a sequela of a varicose condition. Under these circumstances the tortuous, dilated, indurated vein becomes a marked object, set as it were in a frame of hardened inflamed skin and cellular tissue. The parts themselves will to a certainty be painful, and the pain and tenderness will probably extend up the thigh as far as the groin. Amongst the deep veins the common femoral or iliac is more frequently involved than any other, and what is called a "white leg" is due to this affection; this "white leg" being an œdema of the leg from an obstruction to the femoral or iliac vein, and it is usually the first symptom that attracts attention. Local pain and tenderness, with more or less constitutional disturbance, will always accompany the œdema. In some cases the phlebitis is of a very mild character, and in these a good result may be anticipated; in others it is most severe, and in such suppurative changes will probably take place.

Superficial veins.

Deep veins.

It sometimes happens that a limb will become much enlarged in the deeper but not in the superficial parts, that is, no œdema of the cellular tissue beneath the skin will be present, although the superficial veins will be turgid. The absence of this general system must not, however, mislead; it simply indicates that the superficial circulation is efficiently carried on, and that no stagnation exists sufficient to allow of passive serous exudation taking place.

Progress and result.

When these cases go on favorably the swelling will gradually subside, with every other symptom, and the circulation of the part become restored, the vein either recovering its normal condition, or the blood finding its way through other channels. When they go on unfavorably suppuration will take place, and when the deep parts are involved the case assumes a very serious aspect; for a local or a diffused abscess may result, the latter condition being the more common one, and then, too frequently, blood poisoning ensues, with its usual consequences.

Treatment.

TREATMENT.—The two great indications for treatment in these cases are (1) *to favour the venous circulation of the part, and* (2) *to maintain the general condition of the patient.*

Favour the circulation of the part.

The first is to be attained by elevation of the limb, the foot being raised higher than the hip, and by the application of warmth to the part in the shape of fomentations or cotton wool.

Attend to general health.

The second is to be carried out by the administration of a simple nutritious diet, tonics, as quinine, bark or iron, and stimulants carefully adjusted to the wants of the individual case.

Pain must be allayed by local and general means, such as poppy fomentations, and the internal use of opium, morphia, or chloral.

Leeching should never be employed, nor mercury in any of its forms; such practice was based on a mistaken pathology, and should be discarded.

When suppuration occurs.

When suppuration appears it must be dealt with on ordinary principles; it being wise as a rule to evacuate pus as soon as its presence has declared itself.

Diffuse or suppurative phlebitis.

There is, however, another form of phlebitis that must be mentioned, and it is by far the most serious. The *unhealthy diffuse or suppurative phlebitis.* It is an affection of the cellular tissue around the veins, the veins themselves being secondarily involved. It is a kind of erysipelatous inflammation of a low type, and it is only found in the feeble and cachectic. It may be after a severe injury to, or operation on, bone, or otherwise; after a slight contusion or a severe wound; it may follow the puncture, division, or ligature of a vein, or chronic suppurative disease, more particularly of the bones of the cranium. It occurs also in the puerperal state. Depending upon a vitiated condition of the blood, "we are able to appreciate how it is that the many different forms of phlebitis may follow various dissimilar injuries, and reconcile the frequency of their occurrence after operations involving the venous system. The dangers are not to be looked for when the general condition of the system of the individual is good, and when the walls of the vessels are in a healthy state, but they may be anticipated in enfeebled and broken-down constitutions, more particularly when the coats of the vessels are abnormally changed. Upon such a class of persons operative procedure should, therefore, if possible, be avoided." Dr. S. W. Gross, 1867.

Depends on vitiated blood.

Local symptoms.

The disease shows itself as a purulent infiltration of the cellular tissue surrounding the vein, with a thickening and softening of the coats of the vein itself. As the disease progresses abscesses form around the vein, whilst the circulation through it is arrested by the formation of coagula in one spot, and a sloughing abscess in another. In superficial veins, such as in the leg, all these changes can be well seen, in the deep they are difficult to diagnose. In the superficial, the external signs of inflammation will be well marked, local redness and brawniness of skin, around a dilated, thickened, and tortuous vein being the chief symptoms. As the disease progresses local abscesses will appear in the vein itself, and on this being opened blood and pus will escape; the contents being, doubtless, broken-down coagula.

Constitutional symptoms.

The constitutional symptoms will vary with the extent and severity of the disease; marked depression of the general powers will always be present, and rigors will not only usher in the attack, but attend its progress; each one probably indicating some suppurative change. Local pain and sleeplessness are common accompaniments, and in cases that cease to be local and have an infective tendency what are called typhoid symptoms occur. When blood poisoning or pyæmia appears the symptoms will be such as have been described in an early chapter.

On the Presence of Air in Veins.

On air in veins.

Mortality.

That air may find its way to the heart through an open vein, and cause sudden death, is a clinical fact that all surgeons should be familiar with; and that it generally arises during the removal of tumours about the neck and axilla, amputations at the shoulder-joint, and operations or wounds involving the cervical or other veins, is fairly proved by statistics. It has likewise occurred in uterine surgery from the injection of air or gas, &c. Two thirds of the patients affected die from the accident, half within a few minutes, others living hours or a few days. The accident is favoured by a thickened state of the vein. It is generally indicated during the progress of an operation by a sudden gurgling, hissing, or bubbling sound in the wound, associated with venous bleeding, sudden faintness and insensibility of the patient, or convulsions, probably terminating in death. When this result does not at once take place there will be laboured and irregular respiration, tumultuous action of the heart and feeble pulse, the lividity of the patient gradually disappearing; the heart may then regain its natural action, and the patient recover. Bubbles of air may at times be seen in the wound. In some cases the patient will give a sudden cry with the first onset of the symptoms.

Symptoms.

After death evidence of the admixture of air with the blood has been found, bubbles existing in the vessels of the brain, large venous trunks and arteries. In some cases air has been found in the right cavities of the heart. Where a suspicion of this cause of death exists the heart and large vessels should be opened under water to make manifest the escape of air-bubbles—one single bubble indicates air in the heart, many bubbles air in the vessels. Experiments on animals by Erichsen, and others by a French commission, tend to confirm this observation.

Treatment of air in veins.

TREATMENT.—How to deal with these cases is the next point to be considered; and without doubt preventive are more important than curative measures. The Surgeon in dealing with large veins, or, indeed, any veins near their cardiac ends, should be careful to apply pressure upon them, and to maintain it during the operation; in some instances it is more expedient to ligature before dividing or twisting them. When the bubbling sound has been heard, pressure must be at once applied to the spot where the bubbles appear. When a large vein has been wounded by accident, and its division is not required, the opening must be taken up by forceps and carefully closed with a fine silk ligature. Let the Surgeon always avoid large veins when he can.

Artificial respiration.

When air has been admitted into the heart, and its action interfered with, the Surgeon's aim must be to keep up its action, and help the respiratory act by artificial means; such as by cold water on the face and thorax, stimulants, as ammonia to the nostril, &c. Amussat ascribed recovery in one of his cases to pressure upon the chest, leaving the opening in the vein free to allow of the escape of the admitted air; but in adopting this practice care must be observed to close the orifice of the vein in the inspiratory act. Brandy and diffusible stimulants must also be freely given to sustain and stimulate the vital organs.[1]

Stimulants.

Hypertrophy and atrophy of veins.

Hypertrophy and atrophy of veins occur in precisely similar circumstances as hypertrophy and atrophy of other structures. Thus where increase of function of a part exists or increased growth, the veins will elongate, dilate, and thicken. When decrease of function or disease of a part takes place the veins waste or become atrophied with other structures. Thus after amputation of the thigh the femoral vein becomes as small as the anterior tibial; and in Mr. Cock's case of arterial varix related in page 439 the vein above the varix withered to a mere cord. In both cases the vessel had been rendered functionless. On the other hand in the same case of arterial varix the popliteal vein below the varix when taking on the action of an artery became much enlarged and thickened, in fact hypertrophied, simply on account of the increase of work it had to perform under its new condition; and the superficial cutaneous veins through which the whole of the returning blood must have passed were enormously enlarged. An equally good instance of hypertrophy of veins is seen when any obstruction occurs to one of the cavæ or any large venous trunk, the venous circulation making its way through other channels which consequently enlarge. Thus in Fig. 143 the skin veins of the abdomen and chest are seen to be enormously distended and hypertrophied, to carry on the circulation from the lower part of the body to the heart; the lower vena cava having been completely obstructed from cancerous disease. The woman, æt. 47, a patient of Sir W. W. Gull, had no œdema of the lower extremities all through the case, thus proving the perfection of the compensatory venous collateral circulation, and probably indicating the gradual progress of the obstruction.

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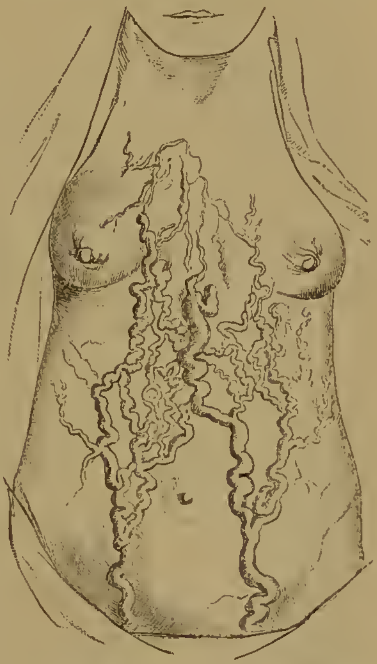
[1] The reader may refer to an admirable paper on this subject, by Dr. J. S. Green, of Massachusetts, 'Amer. Med. Journ.,' 1864.

Examples.

FIG. 143.



Taken from a woman æt. 47 (under the care of Sir W. W. Gull, Bart.), in whom the inferior vena cava was completely obstructed from cancer. Guy's Hosp. Mus., drawing 44^{40}.

Calcareous and atheromatous diseases of the coats of veins may occur, but they are rare affections when compared with their frequency in the arteries. In the Guy's Museum 1538^{25} there is a good specimen of ossified saphena vein, and at St. Thomas's Hospital and the College of Surgeons' Museums may be found examples of calcareous degeneration of other veins. Gay has also described a dissection of a varix which "appears to have been occasioned by disease, originally atheromatous, followed by softening and ulceration of the inner and middle tunics of the vessel;" and Mr. Pick, of St. George's Hosp ('Path. Trans.,' 1867), has given a somewhat similar example. How far, however, this atheromatous and calcareous degeneration is a distinct disease, or an "after change in some local deposit of fibrin," is an open question.

Atheromatous and calcareous diseases of veins.

Varix; varicose disease of the veins and phlebolithes.

The term varicose vein is an unfortunate one, as it is applied to any enlarged tortuous vessel, to such as have been already described as hypertrophied veins, and to others that are clearly due to some diseased

Varix; varicose veins.

Definition. action resulting in hypertrophy with dilatation. In the present page the term will be confined to the latter condition. Varix is commonly an affection of the veins in the lower extremities and mainly of the branches of the saphena vein; when it involves the submucous veins of the rectum it is called a hæmorrhoid, when of the spermatic vein a varicocele. But "all the veins of the body may become varicose," said M. Briquet in 1824. In 1869, a child, æt. 4, was brought to me with a sacculated varix the size of a nut connected with a vein on the outer side of the right forearm; it had been coming on for a year and a half. Taking varix of the lower extremity as a type of the affection, it appears as a disease involving one or more, and in extreme cases all, of the branches of the saphena vein. In most instances it is confined to the larger trunks, and rarely spreads to the smaller tributaries.

Examples.

Description of the disease.

In some, however, the affection appears to begin in the capillaries of the skin, and spread towards the larger trunks, and such cases are most common in women. They appear as "clusters of diseased venous radicles" (Gay) and rarely involve other than the smaller branches.

It must not be thought, however, that this affection is one of the superficial veins alone, for such is not the case. Boyer, many years ago, said it was, and upon his authority the opinion has been accepted. Verneuil corrected the error, and in the 'Gazette Hebdomadaire et Médicale,' 1855, showed that varix is as often a disease of the deep veins as of the subcutaneous, the latter often indicating the existence of the former; he believed, moreover, that the intramuscular veins are sometimes affected without the subcutaneous. More recently Callender has told us that the varix of a subcutaneous vein is found wherever the intramuscular veins pass into the subcutaneous, stating that "the valves obstruct below, and the column of obstructed, slow-moving blood resists above." He has failed, however, to confirm Verneuil's remarks that varix of the intramuscular branches is constant.

Gay's remarks.

Mr. Gay, an able author on varicose veins (1868) says, after many dissections, that "with superficial varicosity there are other serious lesions affecting both arteries and veins, deep and superficial, such as would lead to the conclusion that the general circulation has been subject to very considerable and long-standing embarrassment, some incompetency of the arterial system or impediment to the venous, or both combined;" and these conclusions are probably right.

Causes of varicose veins.

The causes of varicose disease of the vein are obscure. The Surgeons of old were in the habit of looking upon such affections as the invariable result of some obstruction to the venous circulation, such as prolonged standing, the presence of abdominal or pelvic tumours—pathological, fæcal, or fœtal; patients of a relaxed and feeble habit naturally suffering more than the robust; and, in a measure, there can be little doubt that their opinions were correct. Mr. Herapath, of Bristol, used to maintain that the cause of varix was the narrowing of the saphenous opening of the thigh, and cases are on record where its enlargement proved of value; we want, however, facts to support this view. General testimony also admits that this disease is as common in the higher ranks of life as in the lower; that it is as common in women as in men; that it is as frequent on the right side as the left, and more frequently is found on both sides; that it is a disease of the young as much as of the middle aged; that it is found in the strong and healthy as well as in the feeble and cachectic; in fact that it is found under every condition of life, and in every variety of subject. Some evidence exists that gout and hereditary predisposition are efficient causes, with local injuries and prolonged muscular exertion.

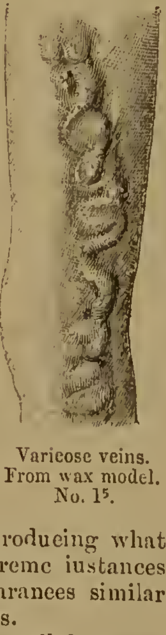
Symptoms.

The symptoms of this affection vary according to the place of its origin. When it commences in the venous capillaries—its common seat in women—it appears as a fine capillary injection, giving an arborescent appearance to the skin, with more or less congestion; and as it extends, the larger venous trunks become involved, the main trunks in these cases being rarely affected.

When it originates in a large trunk the varix may appear as a fusiform enlargement, or a simple dilatation of the whole length of the vein. In some cases there will be thinning of the venous coats, in others a thickening, whilst in a third class one part will appear thin and another thick.

In some cases the affected vein becomes tortuous and knotted to an extreme degree, it being far from unusual to find it the diameter of a finger (Fig. 144). The valves of the veins under these circumstances are clearly lost, not however from a yielding due to backward pressure of the column, but from their action being rendered imperfect by the dilatation of the vein behind; the "valve cusps being unable to meet and close the canal shrink and atrophy."

FIG. 144.



Varicose veins. From wax model. No. 1^5.

Progress and results.

As the disease progresses the tissues around the affected vein are gradually absorbed; the skin becoming thinned and the bone even grooved; the skin may indeed become so thin as even to rupture, and a fatal hæmorrhage is far from being a rare result. At Guy's during the last few years several cases of the kind have taken place. At times subcutaneous rupture of the vein may occur. In 1858 I saw a severe example of this in a man æt. 62. More frequently, however, the soft parts around the diseased vein thicken or inflame. They thicken from a kind of passive exudation into the cellular tissue, the result of impeded venous circulation, and give rise to a slightly anasarcous condition of the part, which in chronic cases becomes somewhat permanent, producing what Liston so well described as a "solid œdema." In extreme instances this solid œdema is so marked as to give rise to appearances similar to the disease called "elephas," or Arabian elephantiasis.

May simulate elephas.

May inflame.

On the other hand, it is a very common result for the cellular tissue around the vein, and probably the vein itself, to inflame. The parts around the varix or tortuous vein become indurated, red, and painful. In healthy subjects this inflammation may end as an adhesive one (local adhesive phlebitis), and in the feeble as a suppurative one; local or diffused abscesses subsequently showing themselves. When the powers of the patient are very low, or blood poisoning takes place, that terrible disease, unhealthy suppurative phlebitis, as previously described, may ensue.

In the early period of the disease an aching of the limbs on standing, or after exercise, may be the only symptom, a local pain at times indicating the seat. In a more advanced period œdema about the ankle may be observed.

May simulate femoral hernia.

When the femoral vein at the saphenous opening—where the grand venous junction takes place—becomes dilated, the swelling may on a careless examination be mistaken for a *femoral hernia*, for both will disappear on the patient assuming the recumbent posture, and reappear on his coughing; there is, however, this point of distinction, that by local pressure on the crural ring a femoral hernia can be kept in its position, when a femoral varix will readily be made to enlarge.

May give rise to thrombosis.

As a secondary result of varicose disease the blood in the vein may coagulate, and give rise to *thrombosis*, and this coagulum may break up, causing a local abscess, or it may wither and organize, causing occlusion of the vein and consequently a partial cure. There is reason also to believe that this may dry up, and become so altered as to form what are known as *phlebolithes*, for these have a laminated character, and in Dr. Franklin's analysis are said to be composed of protein matter and phosphate of lime, with a little sulphate of potash and lime.

Phlebolithes.

May be associated with eczema.

With varicose disease of the veins there is very frequently associated an eczematous condition of the leg, the eczema being apparently due to the feeble venous circulation of the part; if this eczema be neglected a superficial ulceration of the skin may ensue, and if no attention be paid to this condition the ulcer will become chronic. But beyond this no special form of ulcer can be said to exist as a result of varicose veins, in fact there is no such thing as a "varicose ulcer." Every variety of ulcer is found in practice associated with varicose disease, and the existence of the latter doubtless renders the repair of the former somewhat more difficult. Thus it is that chronic indolent sores associated with varicose diseases have been called varicose ulcers.

Varicose ulcer.

Treatment.

TREATMENT.—Varicose disease of the veins in its early stage is very amenable to treatment, but later on nothing can be more obstinate; the patient may be relieved, but rarely cured. Happily, however, it is not a disease that threatens life, under common care.

In early stage local.

When the affection is first discovered the local treatment must be directed to assist the venous circulation by the raised position of the limb, the patient being recumbent; friction should be steadily applied upwards; all sitting, standing, or walking should be strictly prohibited; and when possible this treatment should be persevered in for three or four weeks. When exercise is allowed steady pressure by a well-applied bandage from below upwards should be maintained, or an elastic stocking worn, and in the course of time, the extent of which varies greatly, a cure may be effected and maintained.

General.

During this time the general treatment must not be neglected. Where the powers are feeble, tonics must be given, and of these iron is the best; twenty drops of the tincture of the perchloride with ten of the tincture of nux vomica being a capital compound.

A generous diet must be given when indicated, and the reverse where the portal system has been overgorged by excess. Mild aperients are always of value under these circumstances, salines being preferable to the purgative extracts. The natural waters are of great value in these cases.

Pressure.

When rest cannot be given, well-applied pressure must be relied upon, the best forms of it being a pad of cotton wool over the part with a bandage of Dommett's or elastic tissue put on from the toes upwards, or good strapping evenly applied. The patient must be impressed, however, with the necessity of assuming the horizontal position as much as he can; aiding the circulation by friction as already indicated, and by general treatment. The bandage should always be put on before the legs are moved off the bed, and removed only after the recumbent position is again resumed.

In bad cases of local varix the pressure may be more local and permanent; a pad of cotton wool well fixed on by strapping being very valuable. When the veins are inflamed they must be treated on principles already laid down in the chapter on phlebitis.

When vein bursts.

Should a vein burst bleeding is readily controlled by the application of a finger to the spot, and any further flow is prevented by the elevation of the limb. A pad carefully adjusted to the bleeding point and fixed by strapping applied like a bandage or by a roller, makes the patient safe.

Operations for Varicose Disease of the Veins.

Natural obliteration.

Surgical attempts to procure obliteration.

It has been observed that nature not unfrequently obliterates a varicose vein by means of a coagulum, which subsequently contracts and even organizes, the clot and vein together forming an impervious cord. Acting upon this knowledge, Surgeons now try to make use of nature's processes, and by artificial means to induce coagulation of the blood in some portion of the varicose vessel, with the hope that it may contract; or so to destroy some part of the vein itself as to compel the circulation to find another course. This is the so-called radical cure—but it is to be thought of only, as Mr. Gay so truly says, when the vein is hopelessly deteriorated, or so inflamed and painful, as to threaten to burst; or in cases in which all palliative and other treatment is inapplicable or has failed.

Caustics.

Caustics were employed by Mayo for this purpose, as well as by Brodie, Key, and others. They should be thus applied:—A small piece of Vienna paste (composed of four parts of potassa fusa and four of quicklime, made into a paste with spirits of wine prior to its application), or chloride of zinc paste of the size of a small pea, should be applied upon the vein, the surrounding skin being previously protected by a ring of plaster carefully adjusted; the paste should be fixed on and left, the object being to cause a slough through the tissues into the vein. This slough should not be large, but three, four, or more applications may be simultaneously made about an inch apart to guarantee success. The caustic may be left for twelve or twenty-four hours and then removed, water dressings being applied to the part. During this treatment the patient must be kept in bed with the limb raised.

Subcutaneous division of vein.

Subcutaneous division of the vein was practised by Brodie, but after some experience he came to the conclusion that "it really appears it is not worth patients' while to submit to it."

Excision.

Excision of a portion of the diseased vein has likewise been employed and has been successful ('Lancet,' June 23rd, 1875), Mr. Marshall taking away some inches of diseased vein with forceps and scissors after having isolated the portion to be removed by means of pins passed under the vein above and below.

Acupressure with subcutaneous division.

The best operation, however, is, probably, that of *acupressure*, performed by passing a pin beneath the vein, but not through it as in Davat's plan, and obstructing the circulation through the vein by means of a twisted suture either of silk, india-rubber or wire, applied round the pin, or by a piece of thin india-rubber stretched across it on the pin, as suggested by Mr. Lee. Two or even six of these acupressure needles may be inserted about an inch or an inch and a-half apart, according to the extent of the disease. Mr. Lee employs also the subcutaneous division of the vein between the pins at the same time, and my own experience would confirm the wisdom of this practice. Wood employs an elastic steel spring to keep up tension on the ligature till it cuts its way through.

Acupressure with injection.

On several occasions, having obstructed the circulation through the vein as described above, I have injected the vein between the pins with perchloride of iron, one drop being generally enough to cause coagulation of the blood; in others I have used a concentrated solution of tannin; in all a good result ensued; and I am disposed to regard this practice as being preferable to any other. The syringe employed should be that used for hypodermic injections.

Withdrawal of pins.

Fergusson's operation.

The time for withdrawal of the pins must vary according to the effect intended to be produced; when inserted to induce coagulation of the blood only, and not inflammation, they may be withdrawn on the third or fourth day, and in the practice suggested of acupressure and injection this plan should be followed. Sir W. Fergusson states, "they should be left until they have excited considerable swelling and slight ulceration, and in some instances, when the former is not very conspicuous, they may be permitted to separate by ulceration through both vein and skin. I recommend that the process of inflammation should be more implicitly relied upon than that of coagulation;" he adds, moreover, that he has not met with any seriously unpleasant effects out of the numerous instances in which it has been employed.

It must be repeated, however, that none of these operations should be performed where palliative treatment is applicable; they should be practised only in extreme cases. When a vein threatens to burst, or has burst and endangered life, surgical interference is very good.

Gay on obliteration of the deep-seated veins.

Mr. Gay has called attention ('Lond. Med. Soc.,' Oct., 1871) to a class of cases in which the superficial or complementary veins, as he calls them, are obliterated, and, as a result, the return of the venous blood is carried on entirely by the deep veins; these consequently become diseased, the circulation through them becomes feeble, and degeneration of the tissues ensues, associated with deep-seated solid œdema of the limb, not subcutaneous œdema, which belongs to obstruction only in the subcutaneous veins. For this disorder exercise, warm applications, tonics, &c., are called for; bandages and rest do harm.

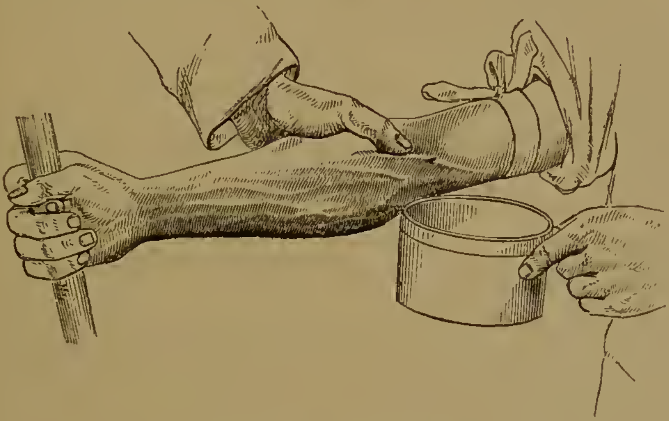
Venesection.

On venesection.

At the present time this operation is a very rare one, indeed, at Guy's Hospital it is as rare as, if not more so than, amputation. Forty years ago it was one of the commonest, and there seems some reason to believe that it will soon be practised again with greater frequency, particularly when we find Sir James Paget asserting "that we undoubtedly over-value the blood, and estimate too cautiously the loss of it;" that "the loss of blood up to fainting and in some cases

I remember with those epileptiform convulsions that come with the loss of blood, is absolutely harmless," that is, when performed upon a large series of healthy persons, as was the custom in his student's days. ('Lancet,' Aug. 15th, 1874.)

FIG. 145.

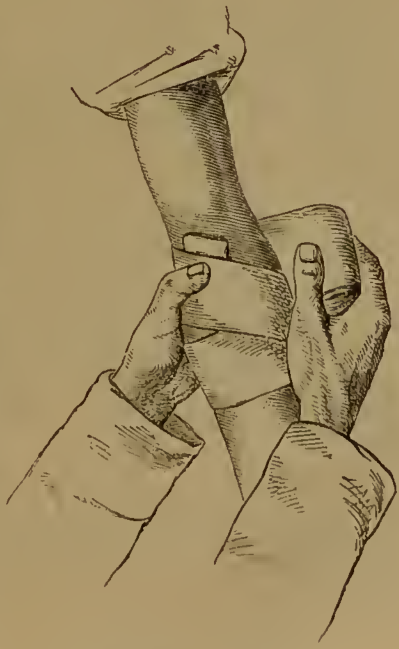


Venesection.—From Heath.

Mode of operating.

It is not a difficult operation, but it requires nicety and care. It is usually performed at the bend of the elbow. The first thing the Surgeon has to do is to render the veins prominent by arresting the circulation through them by means of a piece of broad tape or narrow bandage carried twice round the arm a few inches above the elbow, and tied in a bow, but not tight enough to stop pulsation in the arteries (Fig. 145). He then selects the vein, the largest being the best. Where the outer vein, or median cephalic, is of good size it should be chosen, the inner or median basilic, lying immediately over the brachial artery, but either may be selected, care being observed not to go *through* the vein. The Surgeon should also assure himself that no malposition of the artery exists, for many cases are on record where a superficial artery has been opened for a vein.

FIG. 146.



After venesection.—From Heath.

The vessel having been selected, the Surgeon should stand in front of the extended arm and hold it with his left hand, the thumb being fixed on the vein below the spot which is to be opened. With his right hand an oblique incision, not a puncture, is then to be made through the skin into the vein, describing with the lancet a semicircular movement. The bleeding basin having been brought close to the arm, the Surgeon's left thumb may be removed, and the stream of blood allowed to escape. Should this be feeble, the patient may be made to grasp a stick and put the muscles of the forearm well into action.

Mode of closing wound.

The required amount of blood having been withdrawn, the tape is to be removed, the left thumb of the operator being applied to the wound, and the parts should be cleansed. A pad of lint is then to be placed over the wound, its edges being kept well in contact, the thumb being slipped downwards to allow of the adjustment of the pad, which is to be fixed by a figure-of-8 bandage (Fig. 146). The arm should be slightly bent, care being taken that the pad does not slip during this process.

On the second or third day the pad may be removed, the wound having then probably healed.

Operation on the external jugular.

Opening the external jugular vein is sometimes called for, particularly when venesection is required in a child, and that part of the vein should always be selected where it passes over the sterno-mastoid muscle. The vein is to be steadied and rendered prominent by the left thumb of the Surgeon applied at the root of the neck above the clavicle, or this may be done by means of a pad. The vein is then to be opened with the lancet by an incision made in the course of the sterno-mastoid muscle, and consequently across the platysma. Blood will then freely flow; when enough has been taken the wound is to be closed by means of a pad carefully adjusted, and the thumb, which has been acting as a compress, removed. This pad had better be fixed by good strapping.

Avoid causing a thrombus.

In both these operations of venesection, if the wound in the skin be made smaller than that in the vein, or the position of the arm be changed, a blood tumour or thrombus may form from the escape of blood beneath the integument; and should this interfere with the flow of blood, instead of re-introducing the lancet, the best practice is to untie the arm and apply a pad to the wound, opening a vein in the other arm.

In fat subjects there is occasionally some difficulty in finding a vein. Friction of the surface of the forearm will at times help the Surgeon, or the application of a hot flannel round the arm, which should be made to hang down by the side of the body. When these means fail and venesection is imperative, a vein of the foot may be opened.

Avoid air entering the vein.

In operating on the jugular vein great care must be taken not to admit air into the vein by the removal of the thumb during the operation till the pad has been adjusted, otherwise life may be endangered.

Gross, Dr. S. W., 'American Journ. of Med. Science,' 1867 and 1871.—*Callender*, 'Holmes's System of Surgery,' 2nd ed., 1870.—*Travers*, 'Surgical Essays,' 1818.—*Langenbeck*, of Berlin, 'Archiv für Klinische Chir.,' 1860.—*Arnott*, 'Med.-Chir. Trans.,' vol. xv, 1829.—*Lee, Henry*, 'Disease of Veins,' 1866.—*Greene, James S.*, Dorchester, Mass., 'American Journ. of Med. Science,' 1864.—*Gay*, 'Varicose Diseases of Leg,' 1868.

THE SURGERY OF THE DIGESTIVE ORGANS.

CHAPTER XII.

AFFECTIONS OF THE LIPS, MOUTH, TONGUE, PALATE, AND TONSIL.

Wounds of the Lip.

Wounds of the lip.

These should always be brought together by sutures, which should be deeply inserted, if any gaping exists, for less deformity is likely to follow this practice than when the parts are left to granulate. Under all circumstances the wound should be well cleansed and all foreign bodies removed. Superficial wounds in the inside from the teeth may be left to granulate. When much bleeding exists the Surgeon should examine the part with care, for Erichsen gives a case in which so much blood was lost from the coronary artery, swallowed and brought up again by vomiting, as to lead to the suspicion of some internal injury. Sutures in the lip may almost always be removed on the second or third day. Plaster is, as a rule, not required.

Congenital Fissures of the Lips.

Fissures of lips.

These more frequently occur as harelip than in any other form. Sir W. Fergusson has, however, quoted three cases in his 'Practical Surgery,' in which the fissure extended from the angle of the mouth, in one case to the malar bone, in the second towards the angle of the jaw, and in the third to the base of the lower jaw. The treatment of these cases would be the same as for harelip.

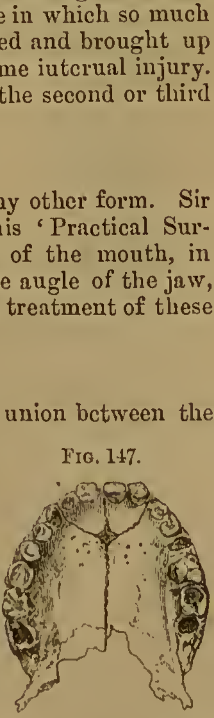
Harelip.

Harelip.

How occurring.

This congenital deformity is due to a want of union between the natural centres of development of the upper lip. Thus, the upper lip is made up of a central and two lateral portions, the central being connected with the intermaxillary bones, and the lateral with the superior maxillary (Fig. 147). A want of union between the lateral and central piece on one side gives rise to simple harelip; a want of union between the central and both lateral pieces to double harelip.

FIG. 147.

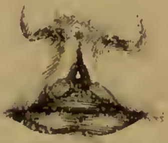


Showing the development of the intermaxillary and maxillary bones.—From Fergusson.

When the fissure is central—a very rare condition—the intermaxillary bones are either absent or divided. A specimen of the former condition exists in the museum of the Royal College of Surgeons, London, and a drawing of such a case taken from a patient of my colleague Mr. Howse, is seen in Fig. 148. These fissures may be partial or complete; they may involve the skin alone or the bone also, and the latter in variable degrees.

I have seen in the lip of an adult (Fig. 149) a congenital cicatrix on the left side of the upper lip with a slight elevation of its mucous margin, said to be the very earliest indication of a harelip, and the child of this woman had a complete fissure. In more complicated cases the cleft will extend through the alveolar process, in a line corresponding with the labial fissure; in others it will involve the hard palate; in a still worse class both hard and soft palate will be fissured.

Fig. 184.



Central fissure of lip, with deficiency of intermaxillary bones. Mr. Howse's case.

May be double.

In a small percentage of the cases—about a tenth—the harelip will be double. In these it is not uncommon to find a double fissure extending through the palate; the two superior maxillæ with the skin having failed to unite with the intermaxillary bones. Under these circumstances the intermaxillary bones will often project forwards, covered with a small flap of skin, at times even standing out from the tip of the nose. In a rare case (illustrated in Fig. 152) the fissure involved the lip and intermaxillary bones alone, the maxillæ being complete.

These points are well illustrated in the annexed drawings, which have been taken from patients to show the different degrees of the deformity.

Fig. 149.

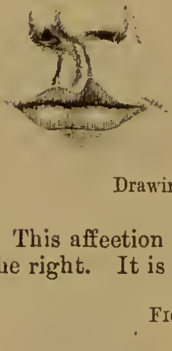


Fig. 150.

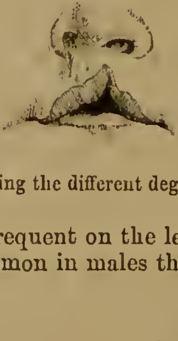
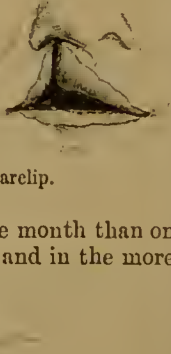


Fig. 150a.



Drawings illustrating the different degrees of single harelip.

This affection is more frequent on the left side of the mouth than on the right. It is more common in males than females, and in the more complicated examples this disproportion becomes very striking. Thus, in an analysis of cases to be found in my 'Lettsomian Lectures on the Surgical Diseases of Children,' 1863, four fifths of the bad cases were

Fig. 151.

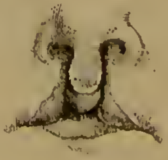
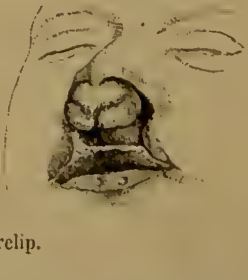


Fig. 152.



Double harelip.

in boys, and cases of double harelip are almost always found in the male sex.

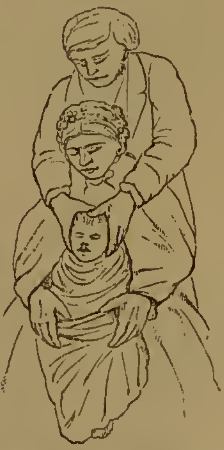
Treatment. Time for operation.

TREATMENT.—When ought a child with harelip to be operated upon? Sir W. Fergusson says, "I am of opinion that the earlier the operation is performed the better—assuredly before teething;" and the majority of Surgeons would support this opinion. Judging from my own experience I am not disposed to coincide altogether with this view, for in my analysis of cases at Guy's Hospital a larger number of failures followed the operation when performed during the first few weeks of life than after the third month. In healthy infants it is probable that success will attend the operation whenever undertaken; but in the more feeble it is also probable that success will be more certain at a later period than at a very early one. Under these circumstances I always advise the operation to be postponed till after the third month; that is, when no necessity exists to hurry on the operation—such as inability to take food, &c. On account of this last-named condition, I have operated with complete success on the fifth day.

How to hold the patient.

The position of the patient is important. If an infant, the whole body and arms should be bound round with a good towel, and the head fixed by the hands of an assistant placed on either side. The child should be firmly held in a nurse's lap in the sitting posture (Fig. 153).

FIG. 153.



Chloroform.

If an older child, the semi-recumbent position should be chosen, with the head raised on a pillow and fixed as directed above. Chloroform should, under these circumstances, always be given. When given to an infant the head may be laid on the Surgeon's knees, the body on the nurse's. The operator may sit or stand behind the patient when the recumbent position is selected, or at one side if the patient be sitting.

The operation.—Anæsthetics may be given without fear in these cases, although in uncomplicated examples the operation is so expeditiously performed as not to render it essential; I operate as frequently without as with it.

Objects.

In the operation the Surgeon has two main objects in view—to pare the edges of the fissure, and to adapt them, so as to render the deformity as slight as possible. But before this an important preliminary step demands attention, upon which the success of the case materially rests, and that is the free separation of both sides of the lip from the alveoli; the object of this step being to allow the soft parts to move freely over the bones and be brought readily into apposition. Some Surgeons save the true frænum and divide all other adhesions; from my experience I see no necessity for this practice. To pare the edges of the cleft the knife should be employed; such an instrument makes a cleaner section than do scissors, and this cleanness of the incision is a point of importance. With respect to the form of incision, numbers have been devised, but most Surgeons fall back upon the old-fashioned straight one, commencing at the apex of the cleft and ending at its free border, care being taken to cut off a good piece. The plan I now always adopt is, when

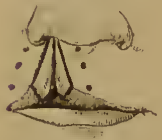
Mode of operation.

the knife reaches the red border of the lip, to turn its edge obliquely towards the cleft, in this way saving a portion of the mucous covering of the lip, and lessening materially the notch in the lip (Fig. 154). The incision having been made, and any bleeding vessel twisted, the Surgeon should proceed to adjust the parts, and he had better commence at the free margin. When pins are used, they should be fine, with flat heads, and one should be introduced about a third of an inch from the margin of the wound, and brought out just under the mucous lining of the lip, reintroduced on the opposite side, and passed through the lip. The edges can then be brought together by means of a twisted suture, care being taken to adapt accurately the parts at the red margin of the lip. Should this end be obtained, the second and third pins may be inserted above, one close to the nostril, the second between the two, and both fastened separately. Should the interrupted silk, gut, or horse-hair suture be employed instead of pins, a practice I much prefer, having given up pins in simple cases, it is a good plan to introduce a needle as the first pin to adjust the parts, and then insert the second and third stitches, putting in afterwards the marginal suture by simply drawing the needle that had been introduced as a pin through the flaps. In some cases it is good to insert a fourth suture into the red border of the lip itself.

Use of pins.

Use of sutures.

FIG. 154.

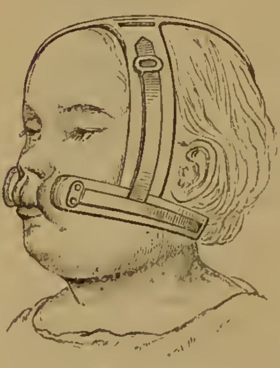


Operation for single harelip.

Hainsby's truss.

After the operation Hainsby's truss should be employed when possible (Fig. 155). It keeps the parts well together and prevents any traction upon the wound. It is a valuable instrument. When it cannot be obtained the cheeks should be well drawn forward and held by some good plaster applied from ear to ear, although when pins are employed this practice can hardly be followed. The sutures or pins may generally be removed about the second or third day at the latest, and after their removal the cheeks must be held forward by strapping.

FIG. 155.



Hainsby's truss.

Collis's suggestions and mode of operating.

Mr. Maurice Collis, in 1866 ('Dub. Quart.'), in an able paper on harelip, amongst other points laid great stress upon the propriety of utilising the parings. He never threw away a particle of them, but used them all. I have followed his suggestions in many cases with admirable success, and am disposed to think that where the lips are thin his method is a good one.

His operation is as follows:—He first makes an incision from A to B (Fig. 156), through the thickness of the lip down to the mucous membrane, but not through it, and turns the flap back. On the other side, he transfixes the lip at C, and separates the flap as far as D, dividing the flap in the centre at E. He then brings the two sides together, the loose lateral flaps covering in the semi-attached one in the central bit. The upper flap C E is fixed by a suture to A, and the lower flap E D to B. Two intermediate sutures being applied

(Fig. 157), I thus get, says Collis, "a lip nearly double in depth what I could possibly have got by the ordinary incisions." Malgaigne's operation is in a measure somewhat similar to the above, utilising as it does the flaps of skin by turning them down and stitching them together (Fig. 158). In some cases, one of the pared edges may be left attached and united with the opposite side that has been sloped to receive it.

FIG. 156.

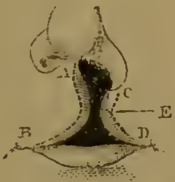
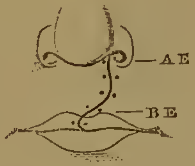


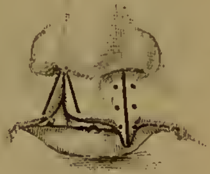
FIG. 157.



Collis's operation for harelip.

Malgaigne's operation.

FIG. 158.



Malgaigne's operation. From Holmes.

Operation for double harelip.

Double harelip.—When this is uncomplicated with bone displacement, it may be dealt with as simple harelip; in a general way it is well to operate upon both sides at once, more particularly if the lower flaps of the lateral portions are utilised by being turned down and united beneath the central piece (Fig. 160). Should there be, however, much separation, and, consequently, traction upon the lateral portions, the operations upon the two sides should be performed separately.

Mode of dealing with the projecting bone.

When the intermaxillary bones project to any extent and are separated from the maxillary, there is some difficulty in the treatment; but I believe the better plan is to remove them with the knife or scissors, for when broken and bent back the central incisor teeth too often grow in some abnormal position and are in the way. When removed, the maxillary bones subsequently approximate, and the lateral incisor teeth often assume the position of the central. Sir W. Fergusson now turns out these bones, or the milk tooth with its bony bed, subcutaneously, and, I think, with advantage. When they are pushed so forward as to form a kind of appendage to the tip of the nose, as seen in Fig. 161, they must be removed. The portion of skin over the bones must, however, always be utilised, either to form a columna nasi where none existed, as in Figs. 162 and 163, or to be brought down and inserted between the two lateral portions of the lip.

FIG. 159.

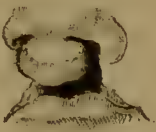
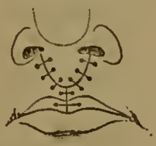


FIG. 160.

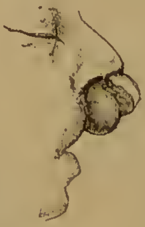


Operation for double harelip.

Utilise central skin.

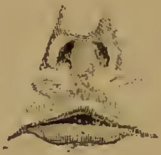
Should primary union fail, the Surgeon will often succeed by scraping the surface of the wound and reapplying the sutures; and he may do this, although the parts have sloughed at first, as soon as healthy granulations appear.

Fig. 161.



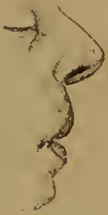
Before operation.

Fig. 162.



(From patients.)

Fig. 163.

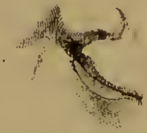


After operation.

Cheiloplastic Operations.

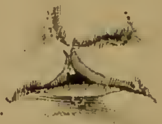
Cheiloplastic operations on lip. These are demanded for deformity of the mouth from destructive ulceration or sloughing, as from cancrum oris; they are somewhat similar to those for harelip. When undertaken for contraction of the mouth, the Surgeon should always try and turn up from within the mouth some portion of the mucous membrane to cover over the new angle, and thus prevent its subsequent contraction. I have done this in several cases with gratifying success; one is figured below; the deformity was the result of sloughing after fever. In some cases new tissue will have to be brought up from the chin or down from the cheek; indeed, these cases tax the ingenuity of the Surgeon to the utmost, for no general rules can be laid down; each case must be treated on its own merits. But this may be said—that no part of the body heals so rapidly or so well as the face, and in none are plastic operations more satisfactory.

Fig. 164.



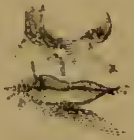
Deformity result of sloughing.

Fig. 165.



After first operation.

Fig. 166.



After second.

Cancer of the Lips.

Cancer of lip. Period of life. This term is generally applied to epithelioma or cancroid disease, true cancer or carcinoma being very rare. It is a disease of middle life, four out of five cases attacking patients between forty and sixty years of age. The youngest subject I have seen affected by it was a sweep æt. 27, and the oldest was a sweep æt. 86. It affects the lower lip more frequently than the upper, in the proportion of 25 to 1, and men more frequently than women. In my own table of fifty-four cases three instances of the latter exist to fifty-one of the former.

Causes. Smoking, or rather the irritation of a pipe, has generally been put down as a common cause, and it is probable that such an irritation is sufficient to set up the disease when a predisposition to its development already exists. It is interesting to note, however, that in fifty-four consecutive cases in which I made the inquiry nine had never smoked. This proportion is probably, in this country, about that of the non-smokers amongst the male population.

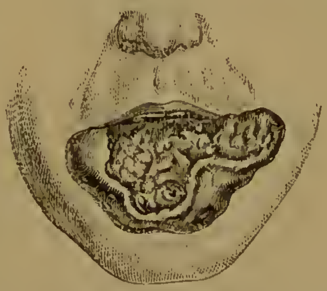
Origin and progress.

The disease generally commences as a dry scab on the red margin of the lip; it may be that this scab forms over a crack or excoriation, but as often as not it appears alone; sometimes it commences as a wart. In its early stage the progress of the disease is generally very slow, and it is only when some ulcerative action appears that it developes more rapidly. It is under these circumstances that the patient first applies for advice; in the dry stage the disease is passed by unheeded.

Appearance of an epithelial cancer.

The appearance of an epithelial cancer is tolerably characteristic (Fig. 167); it has generally an irregular warty aspect, and, when ulcerating, has thickened everted edges. It has always a well-defined indurated base; when ulcerating, it discharges a sanious pus, containing epithelium scales in abundance; when dry it is covered with a scab of the same material. Microscopically it contains epithelial elements arranged in capsules. (*Vide* Fig. 25.)

Fig. 167.



Cancer of lip in John C—, æt. 54. From drawing.

It seems to be a local disease in its early stage, and rarely affects more than one part at the same time. I have, however, seen several cases in which two separate centres existed, and in one case there were three; in this case two growths on the lower lips were excised, and nine years subsequently a similar disease attacked the tongue. In June, 1870, I removed this with the galvanic-cautery écraseur.

Enlarged glands.

When the ulcerative stage has set in, if the disease be left to run its course, the glands beneath the jaw will probably soon become affected. Indeed, under these circumstances the progress of the affection will be steady, if not rapid; it will go on to destroy all the tissues with which it comes in contact—integument, gums, bone, teeth, and glands. It destroys life by exhaustion. It may do so by secondary deposits in the lungs or viscera, but far less frequently than in carcinoma.

Treatment.

TREATMENT.—There is only one kind of treatment that can be recommended, and that is the speedy removal of the disease. When once the nature of the case is clear the sooner the growth is taken away the better; the Surgeon, in doing this, must also deal freely with the parts around. He had better err by taking away too much of the surrounding tissues than too little. To tease the parts with mild caustics is bad practice; it merely irritates and rarely destroys the whole growth. Caustics are not, as a rule, to be recommended. Excision is probably the best method. When the disease is superficial it may be sliced off, leaving the parts to granulate; when it involves more of the lip, a V-shaped piece may be taken out, the two edges being brought together as in harelip. When much of the lip is affected the whole of it must be removed, and a new lip formed by bringing up the soft parts from the chin as indicated in Figs. 168, 169.

Excision.

Caustics not advised.

Removed by the galvanic cautery.

I have, however, with the galvanic cautery removed many superficial cancerous tumours of the lip with success, isolating the growth with pins, and removing it with the wire passed beneath them.

Recurrence of disease.

After the removal of the disease a cure may follow; but in the majority of cases a return will take place, and generally in the same spot. Similar treatment must again be adopted, even to a second and third operation, for there seems reason to believe that after each operation a longer interval of immunity may be promised. Thus, a man who had a cancer of the lip removed one year after its appearance, was well for two years, when a second operation was required; he remained well for three years, when a third was performed, and this time four years elapsed before a return took place. It was then excised for a fourth time.

Fig. 168.

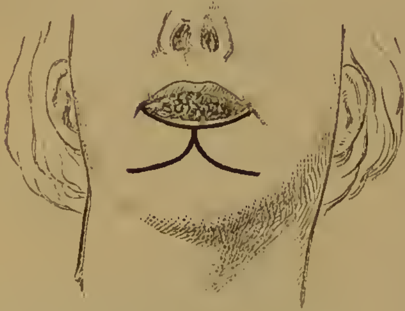


Diagram showing the lines of incision for new lip after removal of a cancer.

Fig. 169.

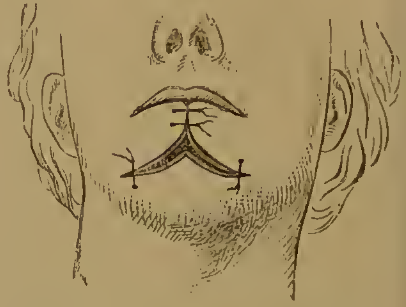


Diagram showing position of flaps when brought up.

In another case a man, æt. 65, had a cancer of his lip removed fifteen years before he came under my care. He remained well for eight, when the disease returned, and a second operation took place; seven years after this he was well. Epithelioma of the lip is of slow growth. I have removed one from a man, æt. 74, of twenty years', and another from a man, æt. 50, of eight years' growth.

Horny growths.

Horny growths may spring from the lip as from other parts of the cutaneous surface. (Prep. 1678^5, Guy's Hosp. Mus.)

Chancre on lip.

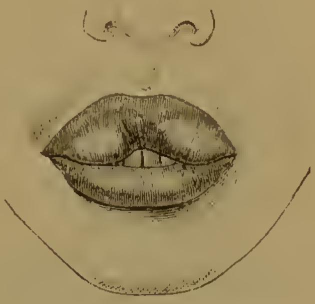
Chancres, syphilitic or otherwise, are at times met with on the lips, and the Surgeon should be on his guard not to mistake them for cancer. They have neither the clinical history nor aspect of such an affection, having a far more rapid progress. They are likewise usually attended with much inflammatory swelling and secondary glandular enlargement. When syphilitic, the constitutional symptoms will mark their true nature. They are, moreover, usually met with in younger subjects than is cancer.

Hypertrophy of the Mucous Glands of the Lip.

Hypertrophy of the mucous glands.

The mucous covering of the lip is often found to be thickened, two elevated or pendulous portions of tissue appearing, one on each side of the middle line. This condition authors have described as *Hypertrophy*, but the name does not appear to be correct, for on removing the so-called hypertrophied mucous membrane a number of small granular bodies, the size of hemp-seeds, and made up of gland-cells, are always found underlying a healthy mucous membrane. The disease appears, therefore, to be due to an increase in the size of the natural glands, and not of the mucous membrane of the part (Fig. 170). It is to be treated only by the careful excision of the diseased submucous tissue—the incision being made in the line of the lip, and the edges brought together by fine sutures. I have seen as many of these cases in the upper as in the lower lip. The disease rarely involves both lips. I have never known it to recur.

FIG. 170.



Hypertrophy of mucous glands of lip.

A genuine hypertrophy of the lip itself is a common affection. It often begins as a chronic inflammation of the part, or rather œdema, the inflammatory deposit becoming organized. There is little doubt that many of the so-called thick strumous lips have this origin. Attention to the general health and its improvement are the means by which any cure may be expected.

Cystic Tumours of the Lip.

Cystic tumours of lip.

Mucous cysts are often seen, and generally in the lower lip. They appear as tense, globular, and at times semi-translucent tumours beneath the mucous membrane. They are readily cured by excision or by cutting off their upper wall by means of scissors and sharp-pointed forceps. An incision into them rarely does good. They contain a glairy mucoid fluid. On several occasions I have turned out of the lip, from beneath the mucous membrane, solid encysted tumours, with a glandular structure.

Adenoid labial tumours.

Nævi.

Nævi of the lip are often seen, and when they involve the whole thickness of the part their excision by a V incision is the best treatment. I have done this on two occasions with a good result. When they are only superficial or beneath the mucous lining they may be treated locally, as already mentioned in the chapter on nævus.

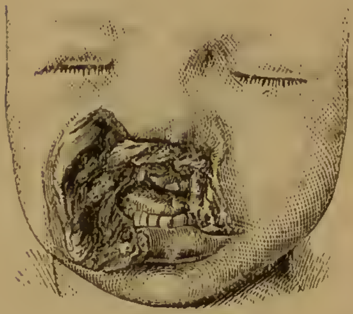
Phlegmonous inflammation.

Phlegmonous or carbuncular inflammation of the lip is an alarming affection; it is never found except in the feeble and cachectic. It attacks the upper as well as the lower lip, and shows itself as a general infiltration of the part, which becomes enormously swollen, tense, and painful. When seen in an early stage a free incision into it or its mucous surface gives relief and expedites the sloughing of the cellular tissue that is sure to follow. Fomentations and warm-water dressings are the most beneficial, with good living and tonics, such as quinine and iron in full doses. At times this affection ends in sloughing, and then puts on the appearance of what is called cancrum oris. It is very prone to be followed by septicæmia.

Cancrum oris.

Cancrum oris, or gangrenous stomatitis, is generally met with in the ill-fed and feeble child after one of the exanthemata. It is seen also where mercury has been given to salivation. It often commences as a phlegmonous inflammation of the cellular tissue of the cheek or lip, going on rapidly to sloughing and phagedænic ulceration, or to sudden death of a part of the cheek, the tissue becoming white and bloodless, and then sloughing. At times this sloughing process will involve a large portion of the cheek, and even of the gum or bone. It is a most fatal and dangerous disease. Before the sloughing has taken place the part involved will be much thickened and indurated. It will feel of a brawny hardness, and appear of a dusky colour in the centre, with a red border. When the skin covering in the dead cellular tissue has sloughed away, a deep, excavated, irregular surface will be seen discharging an offensive sanious fluid, and if the disease spreads it does so by sloughing and ulceration (Fig. 171). It generally kills by exhaustion, sometimes by bleeding from the sloughing of an artery.

Fig. 171.



Cancrum oris.
Model 26^5, Guy's Hosp. Museum.

Treatment.

Treatment.—The general treatment is that by tonics and good feeding, milk, eggs, and wine, beef tea, and any other nutritious food, being of primary importance. When food cannot be taken by the mouth it must be given by the bowel as enemata. Tonics also must be administered, as the liquor cinchonæ, quinine, or iron, in such doses as the child will bear.

Locally, till the slough has separated, little more than fomentations and cleanliness can be employed; but when sloughing and ulceration is spreading the application of strong nitric acid is of great value. It must, however, be liberally brushed over and into the parts, so as to destroy all their surface and induce a fresh action in them.

Absolute cleanliness should be observed, the wound being washed and irrigated by means of a steady stream of water, to which carbolic acid 1 part to 20, Condy's fluid, chloride of zinc or nitric acid, ♏v to the ounce, may be added. When recovery takes place it is frequently with the loss of large portions of the affected parts, for which some plastic operation will subsequently be needed.

Aphthous stomatitis.

Aphthous stomatitis is another affection that is often mistaken for cancrum oris; it is not, however, half so dangerous. It occurs likewise in the unhealthy and ill-fed child, but as often as not is independent of the exanthemata. It begins as an aphthous ulceration of the tongue, gums, lips, or cheeks, by which these parts become covered with a white or ash-coloured secretion. With these local symptoms there will be a foul tongue and fœtid breath, with some evident symptoms of derangement of the bowels and digestive organs. In very feeble children this superficial ulceration may pass on to sloughing of the parts, or *ulcerative stomatitis,* thus simulating *cancrum oris,* but there is this difference—in *cancrum oris* the disease begins in the cellular tissue, the skin sloughing subsequently; in *ulcerative stomatitis* or *noma* it begins as a skin or mucous membrane ulceration, sloughing following upon it.

Treatment of stomatitis.

TREATMENT.—Of all drugs the chlorate of potash has the best action, given in five- or even ten-grain doses mixed with bark, or with milk, a lotion of the same drug, ʒj to a pint of water, being used as an application. Milk diet is the best where it can be taken, beef tea and eggs being given otherwise or in addition. Wine must be administered with great caution, and only when the powers of the child are very feeble, as in the phagedænic form. A rhubarb purge is usually required at the beginning of the affection to clear the way, as foul excreta are too often present, and in the later stage the more powerful tonics, such as iron or quinine, are often wanted. It is a disease that is generally due to intestinal irritation from bad feeding, and requires, therefore, for its treatment careful attention to this point.

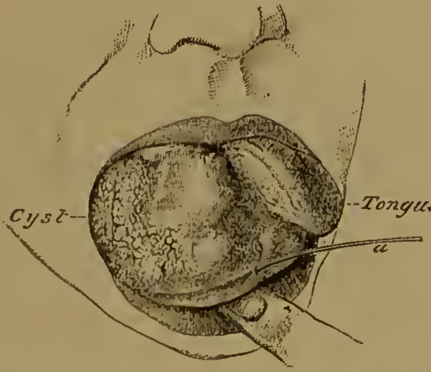
Ranula or Sublingual Cysts.

Ranula.

Nature of the disease.

These are now known *not to be* due to any obstruction of the salivary ducts, submaxillary or sublingual, but to obstruction of one of the mucous glands situated beneath the tongue, such as the glands and ducts of Rivini; they are probably analogous to the mucous cysts of the lip, already alluded to, and of the mucous passages generally. They contain a clear, glairy, mucoid fluid, but never saliva. I have the notes of several that were *congenital.* They sometimes attain a large size, and when placed beneath the tongue, their usual position, the salivary duct can readily be traced lying over them (Fig. 172). Sometimes they are multiple, and on several occasions on opening one cyst I have seen a second within. When neglected and allowed to increase they may so press the tongue upwards as to prevent the patient speaking, or they may form a large swelling beneath the jaw.

FIG. 172.



Ranula or sublingual cyst, with salivary duct lying upon it. Guy's Hosp. Mus., No. 2293^{6}.—Hilton's case.

Character.

From within the mouth they appear as semi-transparent cysts beneath the tongue; they are, as a rule, painless and merely give trouble mechanically; when opened a glairy mucoid fluid escapes. This operation, however, rarely does good, for the fluid re-collects. The best plan of treatment is to raise the upper surface of the cyst by

Treatment.

means of a pair of pointed forceps or a tenaculum, and cut off with scissors its upper surface. In large tumours the cavity may be plugged with lint soaked in iodine, after it has been freely incised. The application of a seton is at times good, but it is an uncertain remedy; simple plugging of the cyst was a mode of treatment that I used to employ till I found out the plans suggested were better. It is impossible to excise these cysts, as they have no definite walls.

Sebaceous sublingual cysts.

Encysted tumours are, however, met with beneath the tongue; I have had two under care, and both I took for ranula. I discovered my error only on opening them; in both on making my incision I had to cut through the mucous lining of the mouth over the cyst, and the cyst-wall itself. In both a cheesy sebaceous secretion escaped.

These tumours have nothing to do with ranula, they have distinct capsules beneath the mucous membrane, they appear to be sebaceous, and are probably congenital. In the cases I have mentioned the patients were under twenty years of age; in both I pulled out as much of the cyst-wall as I could, and dissected it from its bed, in one with complete success; in the second a return took place, which called for another operation, which was followed by a good result. I have never known any of these sublingual cysts require removal from below the jaw; the sebaceous form might do so. In one of my cases I contemplated this plan. Sir W. Fergusson gives a case where this practice was adopted. It is probable, however, that plugging of the cyst, to set up suppuration, would be a simpler and equally efficacious practice.

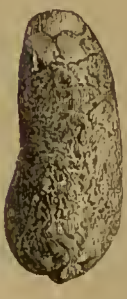
Salivary Calculus.

Salivary calculus.

The salivary ducts beneath the tongue may, however, be obstructed, in exceptional cases from the introduction of foreign bodies, but more commonly from *calculus*. Steno's duct or that of the parotid may be thus affected, but the Whartonian or the sublingual salivary duct is the more commonly involved. When the obstruction is complete patients complain at times, during deglutition, of pain in the corresponding salivary gland, with some swelling, these symptoms being clearly due to retained salivary secretion; these symptoms, however, soon subside on the completion of mastication. In exceptional examples suppuration may attack the gland. The calculus depicted in Fig. 173 was taken from the sublingual duct of a man by my friend Mr. C. Sells, of Guildford; it weighed 48 grains.

Symptoms attending.

Fig. 173.



Salivary calculus, weighing 48 grains.

Diagnosis.

Treatment.

This affection can, usually, be easily recognised on the application of the finger beneath the tongue, the calculus, as a rule, holding a superficial position. On feeling the stone the Surgeon may often with his nail tear it out of its bed. I have removed several when not larger than hemp-seeds by this plan. When larger the best plan is by incision, the Surgeon being careful to cut through the duct where it seems to be the thinnest, and scooping the calculus out of its bed by means of a director or bent probe. At times these calculi attain considerable dimensions, even one inch long. On one occasion I broke a calculus to pieces in attempting to remove it from the centre of a suppurating sublingual gland of a man æt. 42, who had had evidence of its presence for years; he came to me with the parts hard and ulcerating, having been told he had a cancer; a rapid recovery followed its removal.

Size of calculus.

Salivary Fistula.

When Steno's duct, that of the parotid gland, has been obstructed near its orifice in the mouth, or has been opened by a wound or ulceration, a salivary fistula may take place, that is, the saliva, instead of being poured into the mouth, will escape upon the cheek. When this affection originates in some obstruction to the duct itself, it will commence as a soft fluctuating swelling in the cheek, this swelling being caused by retained salivary secretion; and after a time, usually when the duct has acquired about the size of half a walnut, the swelling will ulcerate through the skin, clear saliva or saliva mixed with pus escaping. Should this swelling be opened by the Surgeon the same result will ensue. After this the cavity may contract, but the fistula will remain.

Salivary fistula.

The only successful treatment of this affection is to establish a free opening into the mouth from the oral end of the duct, and this may be effected by passing a fine probe into the fistula through the duct and into the mouth. When this can be done through the natural opening all the better, but this is not a matter of much importance, for an artificial opening near the oral orifice of the duct will answer every purpose. The probe should be armed with a piece of thick silk, or three or four threads of fine silk, and drawn through the mouth, the ends hanging from the cheek and those from the mouth being tied together, the whole acting as a seton, to establish an artificial fistulous communication with the mouth. After about a week or ten days this object will probably be secured, when the seton may be removed. The fistula in the cheek will then probably contract and close of itself; should this not take place the edges of the fistula may be cauterized by the galvanic, gas, or actual cautery, and thus cicatrization be encouraged. The operation may be repeated should it be required. A plastic operation may be attempted should these means fail.

Treatment.

I have known *parotid* salivary fistula follow upon the suppuration of the gland after fever in three cases; the orifice in all was a small one and was placed behind the angle of the jaw. In none of these was it associated with any obstruction to Steno's duct. It was troublesome only from the trickling of saliva during mastication, and to one of the patients, who was a lady, this caused much annoyance. I tried the cautery in one of these cases, but without success.

Cervical salivary fistula.

Parotiditis or "Mumps."

This is a simple, although an infectious, disease; it has a tendency to get well with simple fomentations to the parts, a saline purgative, and some mild tonic. It is occasionally metastatic to the testicle. When it follows upon a fever it is a severe affection, and not infrequently passes on to suppuration; such abscesses spread easily, the

Mumps.

deep fascia covering them in forbidding a natural outlet except by burrowing. Salivary fistula in the neck may follow in such a case. Professor Crocq, of Brussels, believes this disease to be the result of a stomatitis propagated along the duct of the parotid gland to the gland itself.

Parotid and Submaxillary Tumours.

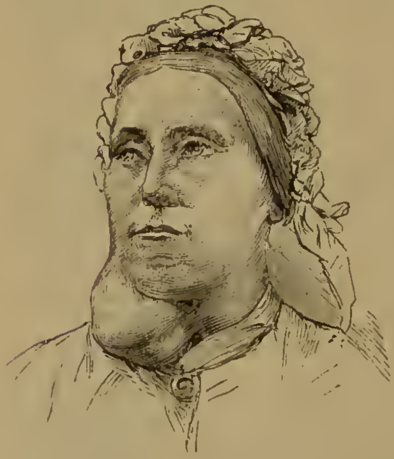
Parotid and submaxillary tumours.

These have one peculiarity, viz. that they are almost always more or less cartilaginous, the ordinary form of tumour in this region being the fibro-cartilaginous; they are, moreover, mostly encysted, and have a peculiar hard, elastic feel and botryoidal outline. They are generally embedded in the structure of the gland, and vary much in their depth; tumours that appear to be moveable and superficial too often dipping well down into the tissues, and thus increasing the difficulty of their removal. These simple tumours may grow to a large size, and stretch the skin greatly over them; they should always be removed, and the earlier the better.

Mode of removal.

In removing them the Surgeon should be careful to make his incision well down to the capsule, when he will probably be able to enucleate the growth: it is far better practice to do this, even with the application of a little force, than to be too free with the knife, for the facial nerve is generally in close contact with the tumour and the deep vessels are beneath. The Surgeon should also always cut upon the tumour, dividing only such tissues as hold it down, and taking great care that the large vessels are left uninjured, if possible. In deeply placed tumours this removal by enucleation is still more necessary. When the tumour is large there is always a strong probability that the facial nerve will be divided or injured, and it is as well, therefore, to prepare the patient for the fact. Fig. 174 illustrates the situation and external appearance of one of these tumours.

Fig. 174.



Submaxillary tumour.

Cancerous tumours of the parotid.

Cancerous tumours of the parotid are likewise met with, but they put on a very different appearance from the last. They are mostly infiltrations of the gland, fixed, diffused, and deep seated; they are generally associated with paralysis of the facial nerve, in this way differing from innocent growths. They should never be surgically interfered with.

Decision as to removal of tumours.

The difficulty of deciding as to the removal of large growths in this position is very great, and the best guide to the Surgeon is their mobility. Sir W. Fergusson, who has had more experience in these cases than any man living, says, "If it were evident that the part slid freely over the subjacent textures, I should not hesitate about using the knife, whatever might be the bulk of the disease," &c.; "but if the tumour seemed fixed, its limits were not clearly defined, or an attempt to move it caused pain, I should not readily be induced to use the knife, however small the mass might be," and these opinions I endorse.

AFFECTIONS OF THE TONGUE.

Affections of the tongue. Tongue-tie.

Tongue-tie is occasionally met with by the Surgeon, but not a tithe of the cases reputed to be so are of this nature. It is due to a tying down of the tip of the tongue by the frænum linguæ, which prevents the infant from projecting the organ beyond the gums, and thus interferes with suckling. It is easily remedied by dividing the frænum perpendicularly downwards behind the gum with a pair of blunt-pointed scissors, the point of the tongue being elevated with the finger, or a pair of dressing forceps applied beneath.

Treatment.

Wounds of the Tongue.

Wounds of tongue.

These are sometimes troublesome from hæmorrhage, but when the parts are brought together, the bleeding as a rule ceases; sutures should always be employed when gaping exists. Should, however, a bleeding vessel be visible, it should be tied or twisted. The sutures must be put in deeply, to draw the whole thickness of the divided parts together. On one occasion, owing to a neglect of this practice, I had to pare the surface of an old wound of the tongue that had passed through the half of the organ transversely, and bring the parts together. The child was unable to talk clearly on account of the injury; after the operation all was well. If bleeding is obstinate, and the parts cannot be brought together, the cautery or perchloride of iron may be usefully employed. In exceptional cases the ranine artery may require a ligature. Ice in the mouth arrests slight hæmorrhage.

Hypertrophy of the Tongue.

Hypertrophy of tongue.

This is a troublesome affection, chiefly from the mechanical obstruction which it causes. It is mostly found in young subjects, and is sometimes congenital. It has been said to be the result of chronic inflammation of the organ, but that such is always the case appears doubtful. When it has existed for years it may cause distortion of the jaws. It may involve the whole organ or only its half; in a case I had under my care not long ago, this latter condition was singularly well illustrated. It is to be recognised simply by the increased size of the organ, no external evidence of disease usually existing. The enlargement, as a rule, is painless, though when the tongue cannot be kept in the mouth, the disease is a distressing one; it is not often amenable to treatment. In the case of a boy æt. 6, who was originally under the late Dr. Addison's care at Guy's, for a congenital enlargement of the organ, the perchloride of mercury in small doses reduced the size of the organ, so as to allow of its return into the mouth, and although several relapses took place in later years, the same treatment was repeated with an equally good result. In a gentleman, æt. 20, who consulted me some years ago for enlargement of the tongue of twelve years' standing, attended with protrusion and all its evils, iodism induced by ten-grain doses of the iodide of potassium was followed within a week by the

Treatment.

speedy disappearance of the affection, although at the time the death of the patient appeared imminent from the excessive swelling of the organ caused by the drug. In other cases the removal of a wedge-shaped piece from the centre of the organ is the best practice; to cut off the projecting portion is far less satisfactory. The application of ligatures to the lingual arteries to starve the disease might possibly be of use in these cases.

Tumours of the tongue.

The tongue may likewise be the subject of *ichthyosis*. Sir James Paget, Mr. Hulke ('Trans. Clin. Soc.,' vols. ii and iii), and Mr. Morris ('Brit. Med. Journ.,' 1874) have recorded examples of the affection, and several have come under my notice. They have a disposition to pass into cancer. They should always be removed. Cases are also on record of *fatty tumour*, of *warty growths*, and congenital *pedunculated* growths, *fibro-cellular tumour*, and *hydatid of the tongue*.

Glossitis.

Glossitis.

Inflammation of the tongue, when deep seated and general, is a grave affection, for the swelling may be so sudden and severe as to threaten life by suffocation. In the sudden enlargements from the salivation of mercury or iodism, as in a case already given, these symptoms are at times seen, but as a rule, they subside rapidly under local fomentation on the removal of their cause. Should suffocation be threatened by the œdematous enlargement of the organ, free vertical incisions might be required, but I have not yet seen a case where such a practice was demanded. Inflammation ending in local suppuration is far more common; and when an abscess has formed the sooner it is opened the better. Should it be placed at the root of the tongue, both deglutition and speaking will be interfered with; indeed, the abscess may mechanically so press upon the epiglottis as to close the larynx, and threaten life.

Abscess of tongue.

Local inflammation of the tongue may come on without any known cause, or from the contact of some irritating substance, such as that of tobacco. It may also follow a wound.

Treatment.

TREATMENT.—Fomentations to the part frequently applied, and an incision into the abscess as soon as it can be made out, are the best local means. Tonics after the use of a mild purge are also useful. When the swelling becomes dangerous by its pressure, the œdema may be dispersed by an incision or a puncture, but the Surgeon need not be in a hurry to adopt this practice; it is rarely needed. The application of leeches to the organ when projecting has been followed by rapid relief.

Aphthous inflammation.

Aphthous inflammation of the tongue and superficial ulceration are not uncommon. It occurs in children chiefly from alimentary irritation, and is cured by the chlorate of potash internally in five- or ten-grain doses as in aphthous stomatitis.

Simple ulcer.

Simple or dyspeptic ulcer of the tongue is a rare affection and a very obstinate one. The few cases that I have seen of it have been in adults in whom considerable disturbance of the digestive apparatus existed. In one the patient passed lithic acid in such abundance as to startle me. He used to bring it in spoonfuls weekly. The ulceration may be extensive, but it is always superficial, and the tongue is usually glazed with it and often red. To the finger it does not feel hard.

Treatment.

TREATMENT.—The only sound treatment is a soothing one. The bowels should be cleared out by a mild purgative such as castor oil, rhubarb and magnesia, and alkalies given, such as the bicarbonate or chlorate of potash in gentian, calumba or bark. The diet should be regulated in the most careful way, and all food forbidden that can possibly irritate. Milk when it can be taken should be allowed. Beer and spirits are generally bad; some little wine or dry sherry may be allowed when necessary. Locally, the chlorate of potash lotion is the best. Caustics and other stimulants are rarely needed.

These cases are not to be mistaken for the syphilitic or condylomatous affections of the organ which are less superficial, more raised and indurated, and are, moreover, usually associated with patches on the throat, lips or cheek, and other constitutional symptoms; nor with the fissures or ulcers that are often found at the side of the tongue due to the irritation of a stump or tooth.

Deep-seated ulcers of the tongue.

Deep ulcers.

These may be *simple, syphilitic*, or *cancerous*. The first is very uncommon, and is usually the result of a local abscess. It can be made out by the sharpness of the edges of the sore, the absence of induration, and the fissured aspect of the ulcer. It has a tendency to get well.

Syphilitic ulcer.

The deep-seated syphilitic ulcer is generally the result of a breaking down of a gummatous tumour in the thickness of the organ. As a tumour it appears as an induration of the part; as an ulcer it appears deeply excavated, with irregular but not infiltrated or everted edges. It is slow in its progress, and not so painful as cancer. It is, moreover, usually found with a history or other symptoms of syphilis and more in the body of the tongue. It may be mistaken for a cancer, and I take it most of the cases of so-called cured cancer of this organ are of this nature.

Cancer of the Tongue.

Cancer of tongue.

This is usually epithelial. It is most common between forty and sixty years of age; like cancer of the lip, it is more frequent in men than women, in the ratio of five to two, and generally commences in and is confined to one side of the organ; an analysis of fifty-five cases ('Just. Schmidt's Jahrb.,' 1860) telling us that it involved both sides only in nine. It begins more frequently as a crack or ulcer than as a wart, and soon gives rise to pain. It increases with variable rapidity, but the majority of patients seek advice after it has existed a few months. It is usually to be recognised by the irregular surface of the sore, its indurated and often everted edges, hardened base, and sloughing surface. As time goes on the glands beneath the jaw will become enlarged, the ulcer with the disease will infiltrate all the tissues as it increases, and the patient's powers will become enfeebled, hæmorrhage from some large vessel too often at the end destroying life.

Treatment of cancer of tongue.

TREATMENT.—Most Surgeons now admit that the sooner the disease is removed the better, for there seems good reason to believe that it is at first a local affection, and that on its removal a cure may be obtained. Should this end not be secured, much good will be gained by the operation, for it relieves a patient for a time from a most distressing and exhausting affection; and should a return take place, it is more likely to do so in the glands than in the part—and death under these circumstances is less painful. The operation, moreover, is attended

Caustics.
Ligature.
Excision.

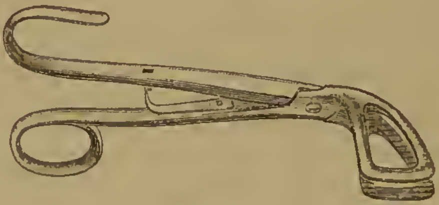
with marvellously little risk to life, and is followed by improved articulation even when the whole organ has been removed. In the case figured (Fig. 176) the man could speak as well after the operation as before. There are only two modes by which this removal *should* be effected, *excision* and the *écraseur.* Caustics are painful and uncertain, and have been rightly abandoned. The ligature is painful and tedious, and beyond the freedom from hæmorrhage it has no advantages; and in this it is only equal to the écraseur. In excision the Surgeon must be careful to remove the whole of the diseased part, cutting well beyond the limits of the tumour; at the same time, when a portion of the organ only need be sacrificed no more should be removed than necessary. It is wiser, however, to take off too much than too little.

Mode of performance.

Galvanic écraseur.

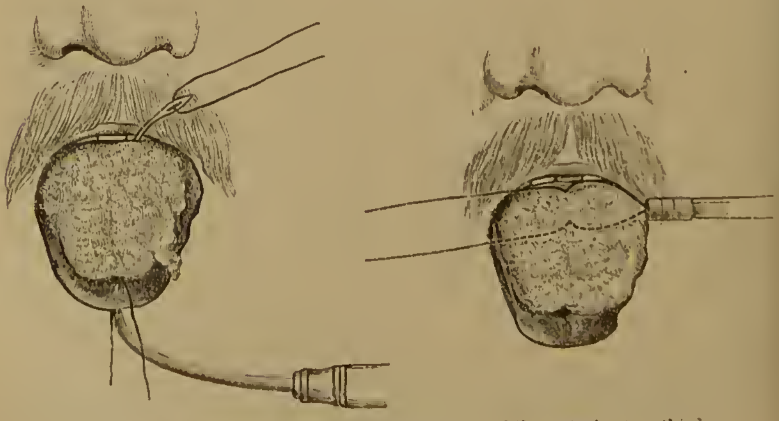
When the disease is limited, and in front, excision may be employed, for with the tongue held well out by a suitable pair of forceps (Fig. 175), or by a ligature passed through the tip, all vessels can be tied or twisted, and bleeding controlled. When the galvanic écraseur, or écraseur wire heated by the galvanic battery, can be obtained, no better means are required for removing small or large portions of the tongue, and since I have employed these means I have given up excision; with pins put in to isolate the growth, and the wire carefully adjusted behind them, any sized mass can be readily removed by a bloodless operation. With the ordinary wire écraseur there is more difficulty in

Fig. 175.



Tongue forceps.

Fig. 176.



Drawing showing the operation for the removal of the anterior two thirds of the tongue.

removing small portions. The amount of the tongue that can be removed through the mouth by these means is measured only by the appliances the Surgeon has at his command to fix its posterior boundary. In the case figured above more than the anterior two thirds of the tongue were removed, and by means of the curved needle shown in the drawing no difficulty was experienced in passing the ligature or removing the organ.

Division of the jaw.

Syme's operation.

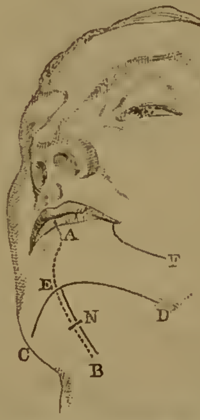
When the diseased tongue cannot be excised with safety, or surrounded with certainty, through the mouth, various expedients have been suggested. Professor Syme divided the lower lip and jaw in the median line to give room for the operation (A to B, Fig. 177). Regnoli, of Pavia, made an incision from the hyoid bone to the chin, and two lateral cuts from the anterior extremity of this along the lower border of the jaw (B to E and C to D, Fig. 177), dividing through to the mouth all the tissues that connected the tongue with the lower jaw at the symphysis, thus giving abundant room to draw the tongue downwards. Nunneley, of Leeds, introduced beneath the jaw, between its base and the hyoid bone, a sharp-pointed curved knife, four inches long, and brought it out in the mouth at the frænum linguæ (N, Fig. 177). With a probe guided upon this knife he then drew through the wound the wire rope of the écraseur, drawing a good loop through the mouth, and withdrawing the probe, the two ends of the rope hanging beneath the chin. He then seized the tongue with forceps, and forcibly pulled it out of the mouth, and pushed through the base of the tongue three long and strong pins, making their ends appear in its upper surface near the base, and behind the disease. He then passed the loop of the écraseur behind the pins and drew it tight, thus completely encircling the whole organ. The process of removal then went on. Sir J. Paget improved upon this, doing away with the submental puncture, and giving freedom to the tongue by dividing the soft parts that hold it down at the floor of the mouth, close to the bone, thus allowing the organ to be pulled well forward. Paget at the same time rightly insisted that care should be taken to divide the tongue perpendicularly through its thickness, and not obliquely; this point is, however, guaranteed by the introduction of pins, as already mentioned. Collis, of Dublin, went one step further, and instead of using the knife as suggested by Paget to divide the sublingual tissues, employed the écraseur. He has, moreover, advised the cheek to be laid open from below its angle to give room for manipulation when the disease is far back (F, Fig. 177). By one or other of these means room can be obtained to free the tongue from its attachments, to isolate the growth by pins, and remove it by the écraseur, wire rope being used when the galvanic cautery écraseur cannot be obtained. I believe Nunneley's method to be the best when the disease is extensive, using the galvanic cautery écraseur; to isolate the disease, I have, however, found the curved

Nunneley's operation.

Paget's improvement

Collis's mode.

Fig. 177.



Illustrating the different operations for the removal of a tongue.

needle as seen in Fig. 176 introduced beneath the chin (x, Fig. 177) through the base of the tongue, behind the disease, to be very valuable.

Summary of modes.

When the disease is placed anteriorly the introduction of pins through the mouth, and the écraseur, are all the means required. When more room is needed, Collis's, Paget's or Nunneley's plan may be employed. When the disease cannot be isolated by these means, Syme's operation must be had recourse to, in which case it will be well to act on a suggestion of Sedillot's, and make the section of the jawbone irregular, to allow of a better adaptation of the segments afterwards than can be ensured when the line of division is a vertical one. The use of the knife had better be confined to the removal of small tubercles in the front of the tongue; all larger pieces are removed with equal facility, and with a smaller loss of blood, by the écraseur.

Ligature of artery.

Ligature of the lingual arteries has been practised by M. Demarquay and others, for the purpose of starving a cancerous tongue, and occasionally with a good result; such a proceeding is, however, only applicable when the removal of the organ cannot be entertained.

Division of nerve.

Division of the gustatory nerve has likewise been practised with success by Hilton (1850) and Moore (1861), for the *relief of pain* in these cases. The nerve can readily be divided by an incision made between the last lower molar tooth and the anterior pillar of the fauces, behind, below, and parallel with, the alveolar ridge, as it descends from the coronoid process.

Fissures of the Palate.

On fissures of the palate.

The hard and the soft palate are both liable to fissure, partial or complete, or, indeed, both palates may be involved. It may be that the fissure appears as a mere notch in the alveolar process, in the line of junction of the superior maxillæ with the intermaxillary bone, as is seen so commonly in harelip, or it may pass backwards towards the velum; on the other hand, the soft palate may show only a bifid uvula or a complete fissure. The fissures in the hard and soft palates are always in the middle line, although where they involve the alveoli they diverge as they involve one or both intermaxillary bones; in fact, they invariably follow the line of suture, as seen in Fig. 147. Fissure of the soft palate alone is more common than fissure of the hard. It is very rare, however, for the intermaxillary bone to be so displaced, as is seen in Fig. 152, without fissure of the palate. These malformations, when severe, give rise to much difficulty in sucking and deglutition, the food passing through the nose. They likewise often interfere much with speech. Partial fissures are of little importance.

Treatment of fissure of palate.

TREATMENT.—When fissure of the palate coexists with harelip, the lip may be operated upon as usual irrespective of the fissure, but it will be well for the patient to wear one of Hainsby's trusses (Fig. 155) subsequently, as the steady pressure of the pads has doubtless a good influence in bringing the bones together. Operations for the repair of the fissure have till recently been put off till the child was of an age to give assistance to the operator. Billroth was the first Surgeon to operate in infancy. He did so with success on a child twenty-eight weeks old in three operations. In 1868, Mr. Thomas Smith introduced to the notice of the profession a gag (Fig. 178) that holds the jaws open and depresses the tongue, enabling the Surgeon, with the patient

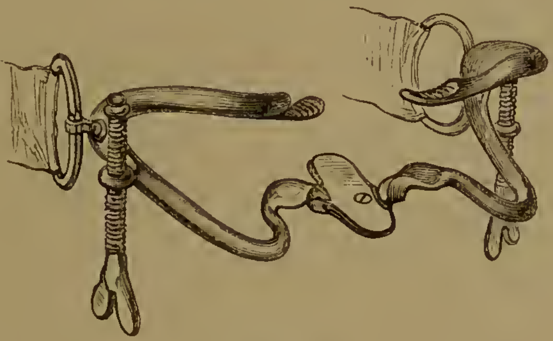
Operations when to be performed.

under the influence of chloroform, to undertake the operation at a very early period; indeed, Mr. Smith has quoted cases where he operated at three years of age ('Med.-Chir. Trans.,' 1868; 'St. Barth. Hosp. Rep.,' 1871). At the age of five, in a healthy child, it may generally be undertaken. I have performed it successfully at four years of age.

History of operation.

Roux was the first who successfully practised the operation, having in 1819 successfully treated a medical student for cleft palate, and Dr. Mason Warren, of Boston, did much towards encouraging the practice; but in this country there is no doubt that to Sir W. Fergusson is due the credit of having demonstrated the value of the operation and of suggesting improvements therein. In his chief paper, published in 1845 ('Med.-Chir. Trans.'), he showed "how the *levator palati* on each side had such free and uncontrolled action that, whenever excited, it drew the margin of the cleft outwards and upwards, and so tugged upon the stitches put in by the Surgeon that ulceration in their sites was a most probable result." He therefore suggested the division of this muscle in all cases, and that of the palato-pharyngeus in some. He did this by means of a curved knife (Fig. 179) passed through the fissure, so that its point can be laid on the tissues immediately above the soft velum, midway between its attachment to the bones and the posterior margin, and about half way between the velum and the lower end of the Eustachian tube. The point is then thrust deep, and carried half an inch or more backwards and forwards so as to cut the levator palati. By these means the palate is paralysed for a time, and thus repair goes on with greater certainty.

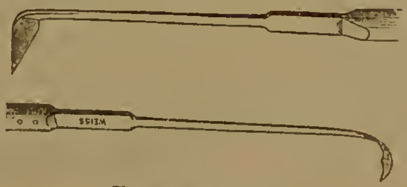
FIG. 178.



T. Smith's gag.

Fergusson's method.

FIG. 179.



Fergusson's knives.

Mode of performing the operation.

For fissures of the hard palate much has been done in more recent times. Dr. Mason Warren, in 1843, described the process of separating the hard from the soft palate with the view of its closure, and it has been left to Langenbeck, Billroth, Pollock, Avery, Lawson Tait, Annandale, T. Smith, and others, to perfect the process.

Chloroform.

The operation.—Chloroform is not necessary in a patient old enough to understand the necessity of being still, and of assisting the Surgeon. In young children with Smith's gag it is an advantage.

Position of patient.

Of Surgeon.

The recumbent position, with the head sufficiently thrown back, is probably the best, although some Surgeons make the patient sit. The operator should stand on the patient's right side or in front. The steps of the operation have been hitherto as follows:—Pare the edges of the fissure; pass the sutures; paralyse the muscles; and fix the stitches. To pare the edges a blunt-pointed bistoury is generally used, and a thin border of mucous membrane cut off from below upwards, the bifid uvula being held by a tenaculum-pointed forceps (Fig. 180). The incision should be made as clean as possible. When the incision is made from above downwards a sharp-pointed bistoury is needed. To pass the sutures a corkscrew needle may be employed, or a curved needle flattened laterally (Fig. 181), with a slit in it for an eye, or an eye in the end. The lowest suture should be inserted first, and both ends held, this practice facilitating the introduction of the others. The best material for sutures is fine gut; Mr. Smith uses horsehair for the lower stitches. I have rarely used anything but gut for all plastic

Fig. 180.

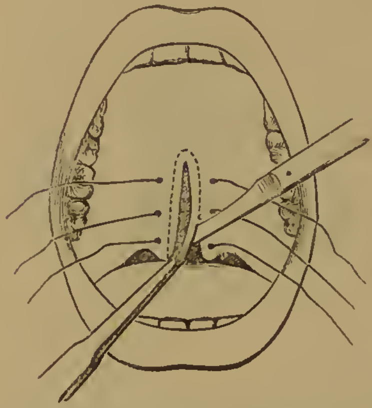
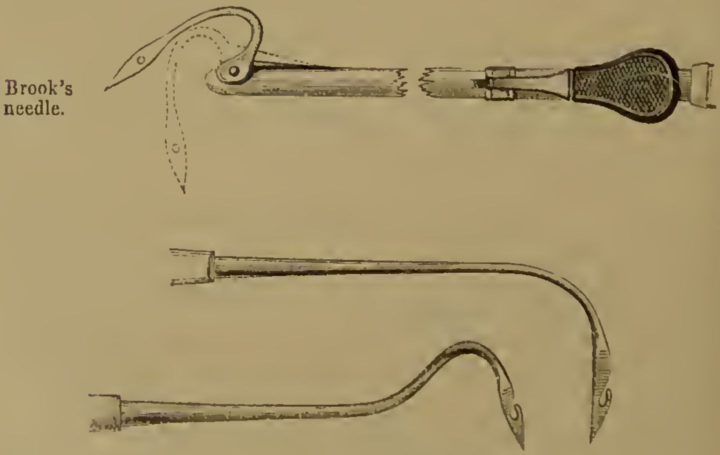


Fig. showing the paring of the edges of fissure after the introduction of the sutures.

Fig. 181.



Needles employed in fissured palate.

operations since the year 1860, taking the precaution to select and to soak it for some minutes in water before using it. During the last two years I have as often as not used silk.

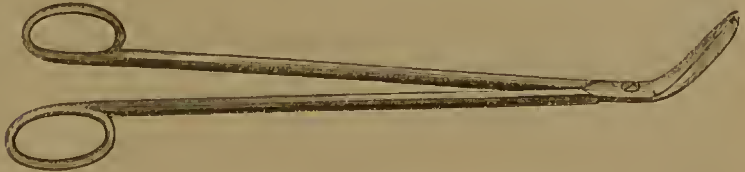
Should Fergusson's plan of paralysing the muscles be employed, it must be done, as he advises, as a preliminary step to the operation. Should Sedillot's or Pollock's plan be followed (Fig. 183), it may be done now by inserting a knife through the velum about a third of an inch from the highest suture, and cutting along the posterior edge of the hard palate towards the free margin, but not through it; it is the one I have till recently adopted. The two pillars of the fauces may then be snipped with scissors. The sutures have now to be fastened, and the best plan is to run a perforated shot over the gut and clamp them, tying the ends of the gut in a knot to prevent the possibility of their slipping. I usually begin at the highest. Care should be taken not to draw the stitches too tight. The parts should be sponged as little as possible, and the less manipulation there is the better; any irritation causing so free a secretion of mucus as to interfere greatly with the Surgeon's proceedings. Rapidity in operating is consequently an advantage. When the parts require to be cleansed in the adult iced water may be used as a gargle; with a child under chloroform the stitches may at times be inserted and the edges pared before any cleansing is required. In deep mouths where difficulty is experienced in passing the sutures a clever manœuvre suggested by Avery may be called for; it is illustrated in Fig. 183; one end of the gut C is pulled through the soft palate and the end passed through a loop of silk (A) inserted on the right side; on pulling the loop the end C will be drawn through the right side. When silk is used the double reef knot as shown at the lower part of Fig. 183, and generally adopted by Fergusson, is a very good one.

Mode of applying the sutures.

Lately, however, I have much simplified the operation, merely by altering its steps; that is to say, I have first introduced my sutures through the soft palate, taking care to do so a quarter of an inch from the free border of the fissure, and secondly pared the edges, employing for this purpose a pair of scissors with short blades placed at right angles to their shanks (Fig. 181A). By this practice the introduction of the sutures is an easy proceeding, and, consequently, very rapidly effected, and the bringing together of the pared edges is as readily accomplished.

New method of proceeding.

FIG. 181A.



Scissors employed for paring edges of the palate.

To relieve tension of the parts I now divide the soft palate laterally, as shown in Fig. 182, A, the side cuts subsequently gaping, B, so as to appear as arches; in this way the muscles of the palate are completely paralysed, and the soft palate itself appears as one large uvula.

I have now performed the operation just described on six occasions, and on all with immediate success. In no one was there even a pinhole left. The simplicity of the proceeding is very striking.

When stitches to be removed.

The stitches may be left in five, ten, or even fourteen days, the amount of irritation they cause being the guide to their removal.

Fig. 182.

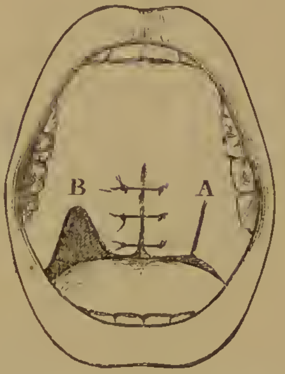
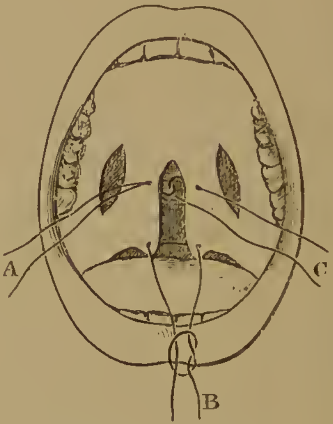


Fig. illustrating line of incision employed to relieve tension of the palate after the edges have been adjusted.

Fig. 183.



A. Avery's plan of passing sutures.
B. Fergusson's plan of fastening sutures.

When union has taken place, however, the sutures can only act as irritants, and in this as in all plastic operations they should be removed as early as they can be with safety. During the process of repair the patient may take soft food freely, swallowing in no ways tending to separate, but, on the contrary, to close the wound. Stimulants may be given if desirable. The operation should, however, only be undertaken in healthy patients; in the feeble it is almost sure to fail. After the operation the patient's friends must not be led to expect that an immediate change for the better will be traced in the voice, for such is never the case, indeed a long interval of time and a process of education is needed to acquire this result, although in many instances the improvement is very great. How far an operation in infancy tends in this direction is not yet proved, sufficient experience in these early operations not having been as yet acquired. Should a small orifice near the hard palate be left after the operation, there is no necessity to interfere again, for it is a clinical fact that they have a strong tendency to contract, and the younger the patient the greater the probability of their complete closure.

Patient to be in good health.

Where a small opening is left.

Tait's modification.

Mr. Tait, however, believes, and I think rightly, that if the mucoperiosteum of the hard palate be elevated with a raspatory from the semilune of the palate bone, the tendinous attachment of the tensor palati will be raised with it, and thus paralysed; in this way doing away with the necessity of any such division of muscles as practised by Pollock or Fergusson, and diminishing the risk of the pin-hole orifice at the junction of the hard and soft palates. He advocates, moreover, two or more operations; the hard palate to be closed first and the soft subsequently after some months' interval.

Fissures of the hard palate.

Fissures of hard palate.

These are to be treated on like principles to those of the soft, the great point of difference consisting in the separation of the soft parts with the periosteum from the bone. For this purpose Langenbeck's instrument is the best—a kind of small hoe; with this, after making an incision down to the bone along the edge of the gum, he scrapes all the soft parts from the bone down to the free border of the fissure, the covering of the palate then hanging as a free curtain. Care is required in this proceeding not to tear or injure the soft parts, and more particularly the anterior and posterior portions where the vessels enter. The other steps of the operation are such as have been described. Since November 22, 1873, Sir W. Fergusson has, however, adopted with great success a method of dealing with fissures of the hard palate which was originally proposed by Dieffenbach in his 'Operative Surgery,' 1845. Although there is a want of evidence that the operation was ever performed, Sir W. Furgusson was not aware of the suggestion when he published his paper ('Brit. Med. Journ.,' April, 1874). The operation, as seen in Figs. 184 and 185, is as follows:

Operation.

Fergusson's new operation.

Holes are first drilled with a curved brad-awl through the margins of the hard palate (Fig. 184, C) for the passage of the threads, and the palate itself is then cut through with a chisel in a line parallel to and about half an inch from the edge of the cleft (Fig. 184, B); this step being much facilitated by acting upon Mr. Mason's suggestion of previously drilling the bone with the curved brad-awl (Fig. 184, A). This loosening of the margins of the hard palate allowing the borders of the cleft to be brought together along its whole length, after the margins have been pared and the stitches twisted (Fig. 185). When any difficulty is experienced in approximating the loosened portions of the

Fig. 184.

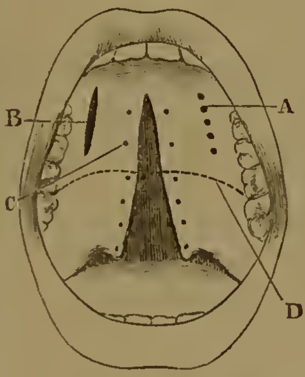
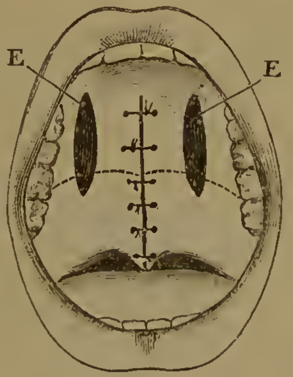


Fig. 185.



A. Preliminary punctures with awl to give line for chisel.
B. Incision through bone completed by chisel.
C. Holes bored through hard and soft palate for sutures.
D. Junction of hard and soft palate.
E. Lateral openings subsequently filled up by granulation.

These drawings were kindly made for me by Mr. W. Rose.

hard palate, the bones may be separated and prised down by means of the chisel and the lateral openings plugged with lint. The operation is clearly a very valuable one.

Use of metallic plate.

When operative relief cannot be given in these cases or has failed, the patient must be handed over to an experienced dentist, for with a good obturator of gold or other material great comfort can be given, and even a velum may be supplied of india rubber; on these points an article in 'Holmes's Surgery,' by my friend Mr. James Salter, may be consulted with advantage. Operative relief is, however, always superior to instrumental, as in the latter the patient is entirely dependent upon the mechanist.

Wounds of the palate'

Wounds of the palate.

are met with in practice from patients falling with pointed instruments in their mouths, such as pipes, sticks, spoons, &c. Small wounds need no attention, they generally do well; lacerated wounds, dividing the velum, should be brought together by sutures; where they have been left and a separation ensues the edges may be subsequently pared and brought together as in fissured palate.

Perforations of the hard palate

Perforation of hard palate.

are generally due to the exfoliation of bone; no plastic operation is of use. The proper treatment of such a case is to close the aperture by an accurately fitting plate of metal or vulcanite attached to the teeth, and arching immediately below the palate, but making no pressure upon the edges of the hole itself, for the effect of a plug is to enlarge the aperture by absorption.

Ulcerations of the hard and soft palate.

Ulceration of palate.

These are very common as a result of syphilis; they appear as *superficial ulcerations* about the pillars of the fauces, and margins of the velum; they are often preceded by an erythematous redness, and then take on a sloughing action in cachectic subjects. They may appear also as *mucous patches* at any stage of syphilis, congenital or acquired, involving at the same time the tonsils, tongue, &c. They appear as slightly elevated spots covered with an ashy or yellowish membrane, beneath which some slight ulceration may be found; they are commonly associated with other symptoms. They are to be treated as part of a constitutional disease, such local treatment being applied as the aspect of the surface may demand. Local astringents, as alum and borax, are as a rule of value, and nitrate of silver also when local stimulants are needed.

Strumous ulceration of the palate.

Strumous ulceration.

This is a distressing affection, the ulcerative action being often so rapid as to destroy within a few days the whole fauces. It is mostly met with in the young and feeble. In other instances it is slower in its action, although equally destructive, gradually eating away all the soft tissues, even to the hard palate and pharynx. It is often mistaken for syphilitic disease, or *vice versâ*. The history of the case alone will determine the point. Tonics and local stimulants are, as a rule, the requisite treatment; good food, of a liquid nutritious kind, being given in abundance. When gargles are difficult to use, carbolic acid lotion, Condy's fluid, or iodine lotion, a drachm of the tincture to a pint of water, may be scattered over the parts with the spray producer. In certain cases a powerful local caustic, such as nitric acid, applied with a glass brush, will tend to arrest the action. As a result of ulceration

Treatment of ulcers of palate.

of the soft palate, it sometimes happens that the palate becomes completely adherent to the posterior part of the pharynx. In one case under my observation there was only an opening the size of a crow-quill between the pharynx and the nose. In another, a central fissure existed leading down to the œsophagus and upwards to the nose. In this case the patient experienced great difficulty in deglutition. He had to eat with the greatest caution, otherwise the food would pass into the larynx. Cases are on record in which it has been found necessary to enlarge this opening, and even to open the trachea to maintain life; under such circumstances it is probably a wise maxim always to open the windpipe before any operative interference is undertaken to enlarge the pharyngeal opening.

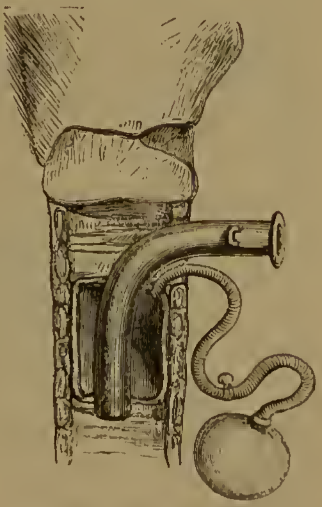
Adhesion of palate to pharynx.

Tumours of the palate, or new growths, are rarely seen. I have met with several cases of warty growths, simple and malignant, and in 'Guy's Reports,' 1869, I have recorded an interesting case of myxoma, that covered the whole of the hard palate, and was cured by removal.

Tumours of palate.

In August, 1872, I also removed from the soft palate of a man æt. 38 a globular fibrous tumour of six years' growth, the size of an unshelled walnut, which had been for six weeks seriously interfering with deglutition and respiration. I enucleated the growth after making a free incision into its capsule, having previously been obliged to perform tracheotomy to prevent suffocation. In this case I employed Dr. Trendelenburg's tracheal tampon (Fig. 186), and found it of great value; it effectually prevented the entry of blood into the air-passages, allowed the patient to be kept under the influence of chloroform, and enabled me to complete the operation with facility and safety. (*Vide* 'Med. Times and Gaz.,' May, 1872.)

FIG. 186.



Section of trachea, with Dr. Trendelenburg's tracheal tampon.

The majority of cases of tumours that involve the palate spread from the gums or upper jaw.

Elongation of the uvula from inflammatory œdema is sometimes a very acute affection. It comes on rapidly at times, and gives rise to suffocative symptoms. I have seen a case in which the uvula became as thick as a finger, and rested on the tongue with its tip forwards, and of this there is a drawing at Guy's. An incision into it, or many punctures, may give relief; but, as a rule, it is better to cut off the lower half of the organ. Elongation from other causes is far more common, and is generally to be recognised by the peculiar hacking cough and husky voice to which it gives rise, the end of the uvula acting as a constant irritant to the epiglottis or glottis. Indeed, there is reason to believe that not a few of the cases of supposed laryngeal irritation are due to this cause. The removal of the lower half of the organ, by means of a long pair of forceps or scissors, rapidly gets rid of all the symptoms.

Polypus of uvula.

A polypus composed of simple mucous membrane may grow from the uvula. I have removed one from its tip, and a second from the base. They give rise to symptoms identical with those of elongation. I had a case under observation in which the polypus had so long a peduncle as to fall at times into the orifice of the larynx, and excite a violent spasmodic cough, but the patient, a man, refused to have it removed.

Tonsillitis.

Tonsillitis. As an acute affection this is known as *quinsy*. It is characterised by the rapid swelling of the part, acute pain, foul tongue, and fever. Within three days, or longer, suppuration may appear, and when suffocative symptoms make their appearance, the Surgeon's interference may be required. At times life may be sacrificed by the want of surgical attention. Some years ago a case came before my notice where a child, two years of age, was suffocated from the bursting of a tonsillitic abscess.

Great redness and rapid swelling of the organs are the chief local symptoms.

Treatment of tonsillitis.

TREATMENT.—Fomentations externally, the inhalation of hot steam, and saline purgatives, are essential points of practice; in respect of drugs none seem to have so powerful an influence over the disease as guaiacum, an ounce of the mixture with some compound spirits of ammonia being the best form to give; when this is employed early suppuration rarely appears. When an abscess has formed, the sooner it is opened the better. The best way to do this is to cover a straight bistoury to within an inch of its point with lint, and having depressed the tongue with the finger, to introduce it into the swollen tissue, making a free incision; care being taken not to direct the point of the knife outwards, but directly backwards. Should pus appear behind the pharynx it must be let out. Tonics, as quinine or iron, should then be given, with good food, and a speedy convalescence as a rule ensues.

Chronic enlargement of tonsils.

Chronic enlargement of the tonsils. This is frequently met with in feeble children as well as in adults that live in marshy and damp localities. It is often a sequel of the more acute inflammation, but as often as not it appears without any such cause; indeed, there is reason to believe that some of the cases of so-called chronic enlargement of the tonsils are due to new adenoid tonsillitic growths. On two occasions, when removing these enlarged organs, I have turned out of their beds distinct tumours the size of nuts embedded in and surrounded by tonsillitic tissue; these were distinctly glandular, and under the microscope could not be distinguished from tonsil tissue. In both these cases the enlargement was unilateral. Bilateral increase is probably always due to hypertrophy or chronic inflammatory enlargement.

Symptoms caused by enlarged tonsils.

This enlargement gives rise to a peculiar nasal twang in speaking and to a most distressing snoring, the patient as a rule having a half-opened mouth night and day. It is commonly associated with irritable mucous membranes generally. I have seen it so great, in a child three and a half years old, as to prevent the deglutition of solid food, the patient having lived for six months on liquid nourishment. Tonic treatment is essential in all these cases and *simple* nutritious diet. A bark and soda mixture is the best at first to soothe and give tone to the digestive

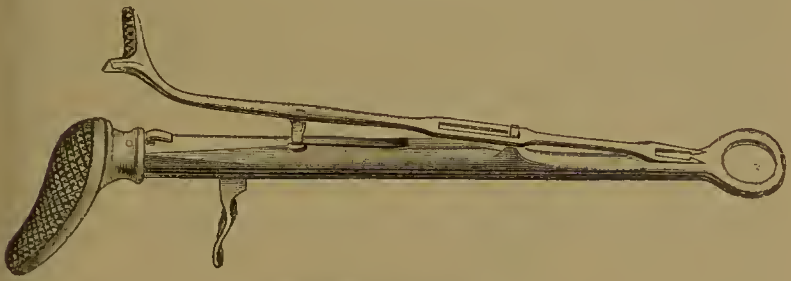
Treatment medical.

apparatus, cod-liver oil, quinine and iron, being subsequently prescribed. When the organs are congested from inflammation the glycerine of tannin is a good application, and when simply enlarged a mixture of glycerine and a tincture of the perchloride of iron, in equal parts, or Liq. Iodi, should be used. It is good also to give the patient some solid iodine to put into a perforated box, standing on a shelf in the day and in the sleeping room, the gradual evaporation of the iodine seeming to purify and iodize the air in a beneficial way.

Removal of the tonsil.

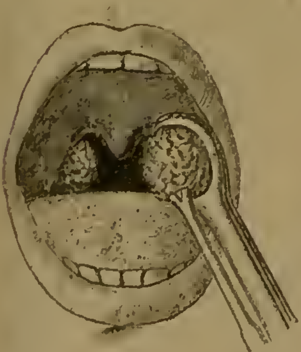
When the glands are white and hard, all hopes of curing them by medical treatment have disappeared; excision is then the only sound treatment. For this purport the guillotine (Fig. 187) is the best instrument to employ when it is at hand, otherwise a pair of vulsellum forceps and a bistoury must be used, guarding the base of the latter with lint or strapping to protect the lips (Fig. 187A).

FIG. 187.



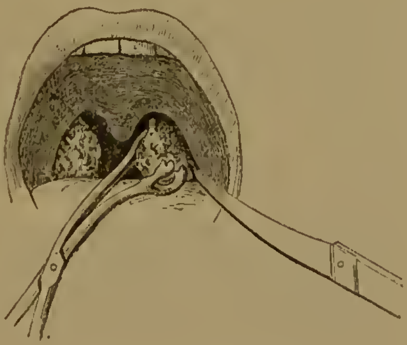
Guillotine prepared for use.

FIG. 187.



Operation on tonsil with guillotine.

FIG. 187A.



Removal of tonsil with knife.

Calculus in the Tonsil.

Calculus in the tonsil.

In 1860 such a case came under my care. A man, æt. 38, after having suffered from enlargement of the right tonsil for a year and a half, expectorated a calculus the size of a nut, the expulsion of it having been preceded for three days by severe local pain and the sensation of something having given way in the parts immediately beforehand. When I saw him there was a distinct cavity in the tonsil. The stone was hard and ragged, and appeared to be made up of phosphatic salts; but the patient claimed the stone, and therefore it was not examined. Small calculi, the size of mustard seeds, are more common. They are supposed to be calcified tuberculous deposits. In Guy's Hosp. Mus. (Prep. 1677^{50}) there is a specimen analysed by Dr. Babington; it consisted of phosphate of lime.

Cancer of the Tonsil.

Cancer of the tonsil.

Varieties.

This rapidly fatal affection is happily rare, and has not received much attention. It may appear as a primary or as a secondary affection, and in the encephaloid or fibrous form. The *former*, the more frequent and rapid in its course, destroys life mechanically by secondary glandular enlargement, and pharyngeal and laryngeal obstruction. The *latter* is seen mostly as an ulceration, and proves fatal by exhaustion.

Characters.

This affection begins as an ordinary enlargement of the gland; it is, however, more rapid in its growth, and is mostly attended by early enlargement of the lymphatic glands at the angle of the jaw, and subsequently of those of the neck; when it ulcerates, the ulcer assumes the indurated jagged appearance of a cancerous sore, not unlike, however, the deep syphilitic sore from the breaking down of a gummy tumour. It has, however, a more indurated base and border than the syphilitic. It mostly attacks men of middle age, but I have had under my care a sweep only seventeen years of age, with the hard form; and I have the records of three other cases in males, aged respectively 49, 62, and 65.

Treatment palliative.

Treatment.—Palliative treatment is probably the best to adopt, although Dr. Cheever, of Boston, has proved to us that the tonsil may be successfully extirpated by external incision ('Boston Med. Surg. Journ.,' 1871). Its removal from within seems almost out of all question, whether by caustics—Maissonneuve's plan—the écraseur, or enucleation. I attempted the latter plan in one case with only partial success. The operation, however, prolonged life.

Cheever's mode of excision.

Dr. Cheever performed his operation through an incision made below the angle of the jaw of three and a half inches, along the anterior border of the sterno-mastoid muscle, with a second incision extending along the lower border of the jaw. The flaps were reflected, and a large gland enucleated. The dissection was continued, and the digastric, stylo-hyoid, and stylo-glossus muscles were divided, the fibres of the superior constrictor being removed by a director. The pharynx was opened. The finger of the operator was then swept round the diseased tonsillitic mass, which was enucleated. The hæmorrhage was free but not excessive; twelve ligatures were applied. A steady convalescence followed. "The facilities," adds Dr. Cheever, "with which the tonsil can be enucleated with the finger is surprising. This operation may probably be a justifiable and good one in those cases before the glands are too far involved. For more information upon this subject, reference may be made to the article "Amygdales," No. 2, 'Dictionnaire de Médecine,' 1865, and to Poland's article, 'Brit. and Foreign Review,' April, 1872.

CHAPTER XIII.

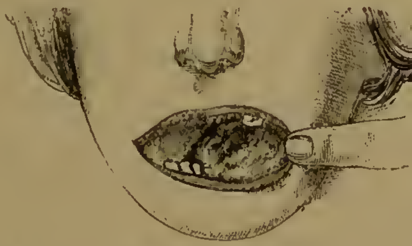
DISEASES OF THE GUMS, JAWS, TEETH, PHARYNX AND ŒSOPHAGUS.

Epulis.

Under this term are included, rightly or wrongly, most of the tumours of the gums—hypertrophic, polypoid, or diffused—simple outgrowths from the gums, due to the irritation of a carious tooth or stump, papillary, fibrous, fibroplastic, myeloid, epithelial, and cancerous tumours. On Epulis. Varieties.

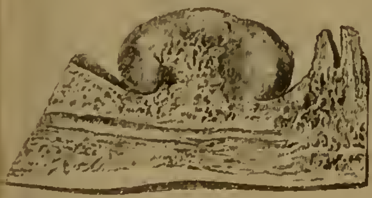
The fibrous, fibroplastic, and myeloid, or *true* epulis—for these elements enter in different proportions into all the benign forms of epulis—are mostly diseases of the periosteum (Fig. 188), and are rarely cured without its removal. At times, however, they invade the bone (Fig. 189), the endosteal membrane which lines the bone being continuous with the periosteal that covers it. They may appear as simple fleshy outgrowths of the gum about a tooth, and develope into a large mass of a firm or semi-elastic tissue. At a later stage this mass may ulcerate and break down. The true form. Characters.

FIG. 188.



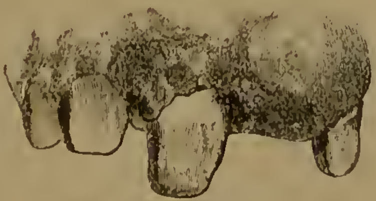
Fibrous epulis from gum. Drawing, Guy's Hosp. Mus., 271¹⁰. Mr. Birkett's case.

FIG. 189.



Epulis springing from bone.
Mr. Key's case.

FIG. 190.



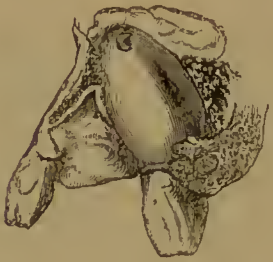
Front view of tumour of alveolus.
(Tooth odontome.)

At times a growth that appears to be an epulis has a tooth origin, and in a boy æt. 11, from whom Fig. 190 was taken, this was the cause, the expansion of the alveolus having been due to the development Case of odontome of upper incisor tooth.

of a true odontome of the fang of the second upper incisor tooth; it had been growing for three or four years.

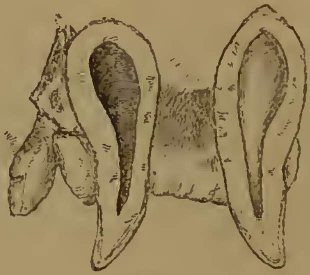
Fig. 190 illustrates the swelling of the gum before the removal of the disease; Fig. 191A, a section of the odontome. My friends Messrs. Salter and Moon tell me this is a unique case. I am at a loss to know how this condition can be diagnosed during life.

FIG. 191.



Odontome after removal.

FIG. 191A.



Section of odontome, showing expanded thickened root of incisor tooth.

Mode of removal.

TREATMENT.—The removal of the disease, of the teeth or stumps that are involved in it and of the bones with which it is connected, is the only sound practice to adopt; a good pair of cutting pliers, which will nip off as much of the alveolar process as seems involved, being the best instrument to use, a small hand saw having marked out vertically the limit of the incision. When the bone is not removed a return of the disease is almost certain.

Cancerous epulis.

A *cancerous* disease of the gums puts on precisely similar appearances to those seen in similar disease of the fauces, face, or tongue, &c., an irregular, excavated, ulcerating surface, discharging fœtid pus, and associated with pain, and glandular enlargement marking its true nature. Most of the cases of cancerous epulis are epithelial. The benign form of epulis is generally an affection of young life; the cancerous of the old and middle-aged.

Polypus.

Polypus of the gum, or outgrowths of gum structure, are met with. They are due to the irritation of carious teeth or to uncleanly habits. They are to be cured by the removal of the growth and its cause.

Vascular tumours.

Vascular tumours are met with on the gums, and generally between the front teeth. They are sometimes associated with carious teeth, but not always. The outgrowth is usually small and more or less pedunculated, bleeding on the slightest manipulation. At times the vascular tumour presents more the features of a nævus. I have destroyed many of these growths with the galvanic cautery with success, but they may be removed by the knife or any caustic. When a carious tooth appears to be the source of the disease it should be removed.

Abscess about gums.

Abscesses about the gums are very common; they are frequently the result of disease of the teeth. Dentists, however, tell us that these gum-boils rarely induce any disease of the bone; they sometimes, however, originate from it. When connected with a carious tooth, and of long standing, nothing but the removal of the tooth will cure the affection. When associated with disease, such as "necrosis," or death of the bone, the removal of the dead portion becomes a necessity.

Necrosis of the Jaws.

Exanthematous necrosis.

This is a common affection, as a consequence of one of the exanthemata, or some fever, and is now fairly recognised; it is more common in children than in adults. It appears as a rule on the decline of the fever, with pain and swelling about some portion of the gums, and rapidly passes on to suppuration and to death of the bone. The necrosis is, however, generally confined to the alveolus, in exceptional instances involving the body of the bone. Both jaws seem to be equally liable to the affection. In the 'Guy's Hosp. Reports' for 1869 I have recorded a series of cases to illustrate these points. In one case narrated in detail, that of a woman, æt. 25, who in infancy had lost a large portion of her upper jaw after measles—the lower jaw had grown up to fill in the deficiency in the upper; it was nearly one inch higher in its vertical measurement on the right side than the left; it seemed, indeed, as if the lower jaw had grown upwards for want of the regulating influence of the natural pressure which the teeth of the upper jaw must exert upon those of the lower when in contact with them. It is a pretty example of compensatory action in nature. I have recently seen a similar case to the above where the increase of growth had taken place in the upper jaw to compensate for a deficiency in the lower.

Compensatory growth of jaw after necrosis.

Phosphorus necrosis.

Necrosis of the jaws as a result of the phosphorus poison is now rarely seen, in consequence of the common phosphorus being less frequently employed than of old in the making of lucifer matches. Dr. Bristowe, in his report to the Privy Council in 1863, clearly showed that it is to its influence the disease is to be attributed, *the amorphous phosphorus* being harmless. The first notice of the affection in this country was by my colleague Dr. Wilks, in the 'Guy's Hosp. Rep.,' 1847, page 163. The disease is an acute one in every sense. It may involve a part only or the whole of the upper or lower jaw, both jaws seeming to be equally liable to the affection; but in the majority of cases the teeth of the affected bone are more or less diseased or deficient, it being a rare thing to find the disease in subjects who have sound teeth, or in any who have a complete set. Some openings down to the bone, either through carious or deficient teeth, appear to be necessary to enable the phosphorus fumes to act upon the bone.

Symptoms.

Progress of disease.

The disease begins in most part by a general aching of the teeth, rapid suppuration and necrosis of the affected bone following. The constitutional symptoms are usually as severe as the local.

Statistics of necrosis of jaw.

Necrosis may also take place quite independently of any of the causes already alluded to; it may take place as a result of fracture, but its true cause is generally difficult to make out. It is found in both upper and lower jaws, and an analysis of fifty consecutive cases shows that nineteen were in the upper, twenty-nine in the lower, and two in both, thus controverting the assertion of Stanley, which has been repeated by others, that necrosis of the upper jaw is a rare affection. It may show itself at any period of life; I have seen it in an infant two weeks old, although it is more common in the young and middle-aged than in the old. It may attack any portion of the bones, and even the condyloid processes of the lower jaw may die and be removed, leaving a moveable jaw by the spontaneous formation of a new joint. The child, æt. 8, from whom I removed the bone, illustrated below (Fig. 192), could move the jaw as well as if the condyle had never been de-

Period of life.

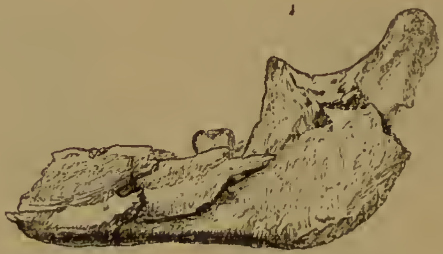
Part attacked.

stroyed, and in the 'Guy's Hosp. Rep.' for 1869 I recorded another case like it.

Is preceded by inflammation.

Necrosis of a bone is always preceded by symptoms of inflammation, such as swelling and pain, followed rapidly by suppuration, and the formation of sinuses leading down to the bone, which may be felt by a probe. A single sinus below the jaw or in the neighbourhood may be due to the presence of a diseased tooth.

FIG. 192.



Portion of lower jaw removed for necrosis from a child æt. 8, the movements of the jaw being subsequently perfectly regained.

Treatment of necrosis.

TREATMENT.—When dead bone can be made out to exist, either in the upper or lower jaw, there is but one form of practice which ought to be entertained, and that is its removal. It should be removed, also, with as little disturbance to the soft parts, or to the new bone-forming tissues, such as the periosteum, as possible. It should likewise be removed by the mouth. When this latter practice is impossible or impolitic, from any cause, the Surgeon should take good care that his external incisions are made where they will be subsequently little seen.

Of upper jaw.

Of lower jaw.

In necrosis of the *upper* jaw the bone can nearly always be removed by means of incisions made *beneath* the cheek. An incision *through* the cheek never seems necessary. In necrosis of the *lower* jaw, when incisions through the integument are demanded, they should be made below its lower border. When the dead bone is fixed, or rather before it has been thrown off from its attachments, and a new casing of bone has not been formed, all operative interference must be condemned, particularly in the lower jaw; for there seems little room to doubt that the muscles, acting upon the new bone before it has become consolidated, may alter its shape and produce deformity. Under these circumstances the Surgeon should content himself with seeing that all pent-up pus has free vent, by means of incisions through the gum, that the patient's mouth is kept as clean as possible by frequent washing, and that his general condition is maintained by means of tonic medicine and nutritious diet.

When confined to the alveolus.

When the necrosis is confined to the alveolus in which the temporary teeth are situated, great care should be taken that the parts beneath are not disturbed, and that the permanent teeth are not interfered with. Even when exposed, however, these permanent teeth need not of necessity come away. In young patients, where much loss of bone has taken place, it seems desirable to have some artificial substitute, to prevent the occurrence of such a compensatory growth as took place in the cases quoted above.

Where antrum exposed.

Where the antrum is exposed by exfoliation much may be done by the dentist to fill in the gap; thus some years ago Mr. Salter very skilfully adapted a plate with teeth to the upper jaw of a woman, in whom the anterior wall of the antrum, with part of the alveolar process, had exfoliated. At times the fistulous opening takes place externally; thus, in 1864, I was called upon to treat a woman, æt. 34, who nine years previously had had extensive necrosis of the upper jaw, and, as a consequence, a fistulous opening the size of a sixpence below the right eye was left, communicating directly with the antrum. The soft parts were firmly connected with its margins, and the lower lid drawn down. I raised the integument from the bone, making free subcutaneous incisions, pared the edges of the flaps, and brought them together over the opening in the bone. Good union followed, and the deformity was removed.

Where fistulous openings remain.

Tumours of the Jaws.

Tumours of the jaw.

Hypertrophy.

Some of the most remarkable tumours of these bones are due to hypertrophy or hyperostosis, the lower jaw with other bones of the face and head being generally involved. Mr. Howship's well-known case of disease of the upper jaw, which is copied everywhere, is a case in point; but a better one is that of Mr. Bickersteth's, which was exhibited at the Pathological Society in 1866, and described with all minuteness in the 'Transactions' of the year. The disease is usually symmetrical, and shows itself as a uniform enlargement of the bones involved, the upper jaws projecting as two large globular masses.

Cystic disease of the antrum.

Diseases of antrum.

This is a special affection, and is often connected with irregular dentition; how often is not yet determined.

Suppuration of cavity.

Suppuration of the cavity is, doubtless, often due to an extension of inflammation from the teeth; it may be caused by a blow, or some other cause. It is known by severe local pain, extending over the face and forehead, local swelling, and extreme tenderness, the constitutional symptoms being often very severe. When pus has formed there may be rigors, and the abscess may burst either into the nose or into the mouth beneath the cheek, the antrum, under these circumstances, becoming much distended. In rare cases it may make its way through the cheek, and in one case in which this occurred an opening into the antrum the size of a silver fourpence was subsequently found, on making an incision down into the bone beneath the cheek. In neglected instances the floor of the orbit may be displaced, and vision interfered with or even destroyed. (*Vide* Salter, 'Med.-Chir. Trans.,' 1863.)

Treatment of suppuration of antrum.

TREATMENT.—When suppuration has been made out to exist the antrum must be opened, and should its anterior wall be expanded, an opening may be made into it at the most projecting point without fear with a trocar or other sharp instrument. The relief this operation gives is very signal. In a case that came under my care in a lady some years ago, it was instantaneous and permanent. When diseased teeth are present in the bone, they should all be tested by a sharp rap, and the most tender one removed. A jet of ether spray upon each tooth will prove a finer test than anything else, the cold searching out the slightest disease. It is never expedient to remove sound teeth unless some evidence exists of their alveoli being diseased. In all these cases the cavity must be kept clean by syringing. A chronic abscess in the antrum may be so insidious in its formation as to induce the Surgeon to believe that a tumour exists; indeed, Liston gives an instance in his 'Practical Surgery' of such an error, in which removal by extirpation was attempted. In all tumours of the upper jaw the probability of the presence of a large cyst should never be forgotten.

Hydrops antri.

Hydrops antri is now a well-recognised affection. It is characterised by a gradual, painless expansion of the bone, rarely producing other symptoms than those due to mechanical pressure; it encroaches on the nose, and causes obstruction; on the orbit, and presses on the globe; on the mouth, and produces bulging of the palate; and on the cheek, so as to cause deformity; indeed, it is often for this that the patient is induced to seek advice. When the expansion is great the shell of bone may become so thin as to crackle like parchment under pressure. This sensation may be yielded by pressure upon its external or palatal surface. M. Giraldès was the first to describe these cysts with clearness in 1853 (Montyon prize), although Mr. W. Adams had previously recognised them. (*Vide* 'St Thomas's Hospital Museum Catalogue.') The old Surgeons looked upon this affection as the result of obstruction to the aperture between the nostril and antrum, the dilatation of the bone being due to retained mucus. This is now known to be an error, all recent pathology tending to indicate that it is a cystic disease of the mucous lining of the antrum, the affection showing itself as a single cyst or as a cystic degeneration of this tissue; Giraldès regards these cysts as dilatations of the glandular follicles of the mucous membrane. The fluid contents of the cysts are always viscid; at times clear, but mostly blood-stained, occasionally purulent, containing cholesterine, but never pure mucus.

Dentigerous cysts.

Dentigerous cysts are, clinically, closely allied to those just described; pathologically they may differ; but there is no doubt that the cysts are connected with the teeth, which are in some cases fully developed, in others imperfectly so. They are found in both upper and lower jaws. Heath, in his excellent 'Essay on the Jaws,' 1868, tells us that cysts of small size, in connection with the fangs of permanent teeth, are frequently found on extracting the latter, but give rise to no symptoms demanding surgical interference. Occasionally growing to a large size they produce absorption of the containing alveolus, and give rise to a prominent swelling. The disease is generally slow in its progress, and tolerably painless; by its pressure the cyst may cause absorption of the bone with which it is in contact, and a deep excavation. Paget relates such a case in his 'Surgical Pathology' as a cyst near the gums, and I have had under observation a woman who had a tumour in her left cheek for years, which was opened, when some watery fluid came away. She applied to me for a bony projection of the cheek, which was clearly the edge of the alveolar process of the upper jaw, the bone above having been absorbed by the pressure of the cyst, thus causing a cup-like depression. She had had all her teeth removed at different times by dentists, under the impression that the disease was due to them.

Symptoms and progress.

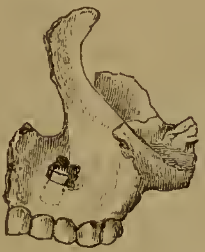
Cysts connected with undeveloped teeth.

The *dentigerous cysts* are found in both jaws; they are almost always connected with the permanent teeth, rare cases being recorded in which the temporary were implicated. In this affection the teeth fail in development and remain within the jaw; the tooth, acting as a foreign body, sets up irritation, and either the cystic affection I am now considering or some solid growth. Thus in a boy æt. 6, that came under my care some years ago, a cystic

Examples.

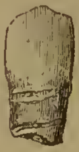
enlargement of the jaw existed of three years' development; it encroached on the orbit, mouth, and cheek. I made an opening into the anterior wall of the cyst, making a window in the bone, and through this a tooth was visible with its crown upwards; it was an incisor, as seen in the drawing (Fig. 193). The tooth was removed and a good recovery ensued. In January, 1872, I treated a similar case in a girl, æt. 17, sent to me by Mr. Salter, who had had her under obvation for two years. The disease was in the right upper jaw, and the right canine tooth was deficient. I exposed the cavity and removed the tooth, which was growing in an abnormal direction upwards and inwards, a good recovery taking place. I saw my colleague Mr. Poland open one in the lower jaw and remove a tooth with success. On July 24, 1875, I trephined a tumour of three or four years' growth of the lower jaw of Miss R—, æt. 30, a patient of Mr. R. Moon's, of Norwood, and of Mr. Salter's, and removed from it a canine tooth which was resting obliquely in the cavity (Fig. 194). Mr. Salter has collected many similar cases. It is well to remember that these dentigerous cysts, like other cysts of the jaws, may simulate solid tumours. When they occur in the lower jaw and expand the bone this error is very likely to take place. In all tumours, therefore, of the jaws that have a smooth or cystic outline it is well to make an exploratory puncture for the purpose of diagnosis. When the walls crackle from the thinness of the expanded cavity the diagnosis is simple.

FIG. 193.



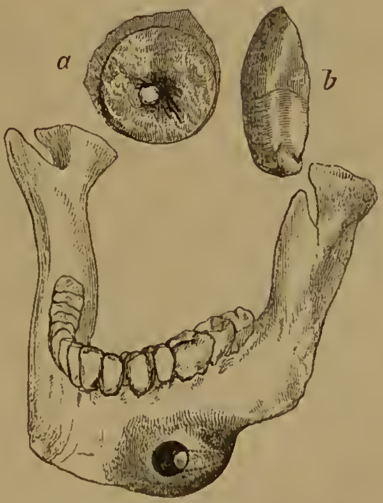
Tooth as seen through opening in upper jaw.

FIG. 193A.



Natural size of tooth when removed.

FIG. 194.



Canine tooth as seen in case of Miss R— in expanded lower jaw with tooth (*b*) of its natural size. *a*. Bone removed by the trephine.

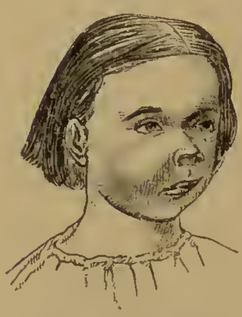
Treatment of dentigerous cysts.

TREATMENT.—The free opening of the cyst is the essential point of practice to observe in all these cystic diseases of the jaws, upper or lower, with the extraction of any tooth that may be present in the cyst. This may be done with a sharp pair of forceps, after a perforating wound has been made by a trephine, drill, gouge, or pointed instrument. To induce suppuration of the cyst it is a good practice to plug the cavity with lint. When the cavity is large it is a wise measure to take away a good portion of its wall. Removal of a bone for cystic disease is rarely needed. Before the pathology was understood, however, this malpractice was often perpetrated, as our different museums too truly testify.

Dentigerous tumours.

Dentigerous tumours may likewise occur. In Fig. 195 is illustrated a case in which I removed the upper jaw of a child, æt. 8, for a nearly solid myeloid tumour of the jaw clearly originating in a malplaced tooth which was growing from the posterior part of the orbital plate of the bone; one or two cysts existed in the growth, enough to call it cystic. There was no possibility of making a diagnosis in this instance; such examples are, however, very rare.

FIG. 195.



Dentigerous tumour of jaw.

Tumours of the jaws.

These are of different kinds—simple and malignant; connected and unconnected with teeth. When in the antrum their dental origin should be suspected, but in both upper and lower jaws solid tumours of all kinds have been found with teeth as their centres.

Polypi of the antrum.

Examples.

Tumours of the upper jaw.

Varieties.

The fibrous.

The fibro-plastic.

The cartilaginous.

Polypi of the antrum—like those of the nose—are occasionally met with, and they mostly show themselves as projections into and through the nostril, the tumour making its way through the nasal wall of the antrum, and at the same time generally expanding its facial wall. I have seen four well-marked cases of this kind; in two the whole mass was removed through the nostril, which was laid open, and turned back. In the third the cheek was reflected outwards at the same time and a large opening made into the antrum allowing the Surgeon to scoop out the growth. Two of these cases occurred in the practice of Mr. Cock, and two in my own practice. Weber, quoted by Heath, tells us that in an analysis of 307 cases of tumours of the upper jaw, rather more than one third of the whole number may be set down as sarcomatous simple tumours, one third as osseous, and less than one third cancerous, the myeloid being included in one of these groups. They may grow also from any part of the bone or periosteum. When they originate in the antrum they expand its cavity as in the cystic diseases, and cause a bulging of one or more of its walls. When they spring from a surface or plate the tumour will project from it, leaving the other surfaces unaffected. The fibrous in all its forms and the osseous are usually of slow growth; they are often painless, and trouble only from their size. The fibro-plastic, myeloid, and cancerous are of more rapid growth. The fibrous or fibro-plastic are usually periosteal growths, the osseous, myeloid, and cancerous endosteal. The cartilaginous are very variable in their progress, at times very slow and at others rapid; they are mostly of the mixed kind, fibre tissue largely predominating in tumours of slow formation; they frequently involve many bones. Sir J. Paget ('Surgical Path.') states that in the only case on record of enchondroma of the upper jaw alone the disease was removed by Mr. Morgan—late of Guy's—from a man æt. 24; the tumour was of the right maxilla and was of nine years' growth. The patient survived the operation seven years. Figs. 196 and 197 illustrate the case; the first was taken before Mr. Morgan's operation, the second after the patient's death. Dr. Heyfelder, of Munich, however, says he found eight such cases out of 450 of disease of the upper jaw.

Fig. 196.

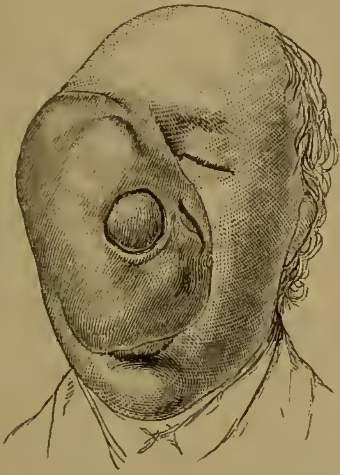
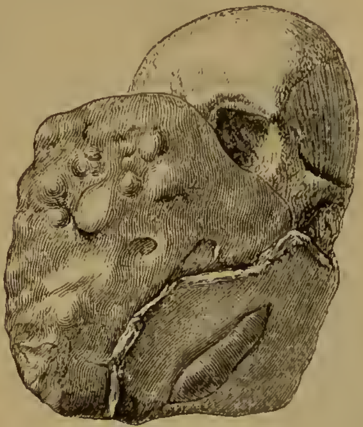


Fig. 197.



Enchondroma of upper jaw.

Before operation. Model, Guy's Hosp. Mus., 38^{10}.

After death. Model, Guy's Hosp. Mus., 38^{12}.

Treatment of tumours of upper jaw.

Treatment.—All solid tumours of the upper jaw are to be extirpated, but no more of the bone should be removed than is sufficient to allow this operation to be performed. To Sir W. Fergusson is undoubtedly due the establishment of this rule in practice, and it is one that all Surgeons should strive to follow. Thus, when the disease springs and projects from the facial surface of the bone, the tumour, with the facial plate alone, needs to be excised. When the alveolar process is alone implicated the other portions of the bone should not be touched. Where possible the palate plate should be preserved, and to touch the orbital plate without an absolute necessity is bad surgery. When the whole bone is involved in the disease it must be taken away, but such cases are exceptional. In many cases where the disease originates in the antrum, a partial removal of the bone will suffice if the Surgeon will at first only lay open the cavity and find out the base of the growth. For perforating the antrum for the purpose of exploring Sir W. Fergusson recommends an ordinary carpenter's gimlet.

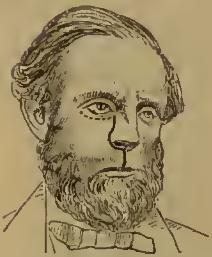
Excision of part or whole of upper jaw.

Operation for the removal of part or the whole of the upper jaw.—The incision now almost universally adopted for the removal of tumours from the upper jaw is that of Sir W. Fergusson; by it all the necessary room is given to remove even the largest growth; the facial nerve and artery are divided where by their size they are of small consequence, and the scars are so placed as to become hardly noticeable. In tumours of *moderate* size the incision is simple, carried through the median line of the lip into the nostril, the raising of the

Description of the operation.

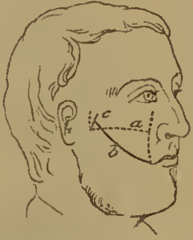
nostril and retraction of the cheek outwards giving abundant room. When more room is required the operator may extend his incision round the ala and up the side of the nose towards the inner canthus, and should this be still insufficient a third incision may be made from the termination of the second, along the lower border of the orbit.

Fig. 198.



Fergusson's incision for removal of upper jaw.

Fig. 199.



The dotted line, *a*, Gensoul's incision; *b*, Lizar's and Liston's.

All these incisions are indicated in the drawings below. Fig. 198 was taken from a man æt. 35, from whom I removed an osteochondroma, of twelve years' duration, involving the facial and palate plates of the superior maxilla. The dark line indicates the incision made; the dotted extra line the one that may be required in exceptional instances. Fig. 199 illustrates Gensoul's and Liston's method.

In some cases the ala of the nose alone may be turned up. I removed a fibrous tumour growing from the nasal process of the superior maxilla by this incision, and found plenty of room. The incision having been made, and integument reflected sufficiently to expose the tumour, all bleeding is to be stopped by ligature or torsion. Assuming the whole bone is to be taken away, the incisor tooth of the affected side must be removed, and the palate plate of the upper jaw, with the alveolus, divided with a fine saw (Fig. 200) introduced into the nostril. The malar process of the maxillary bone is then to be partially sawn through, as well as the nasal process of the superior maxilla, their complete section being made with bone forceps. The tumour is then to be seized, the Lion forceps (Fig. 201) being employed, and the whole wrenched off, bone forceps and scissors being employed to complete any section that may be required. The infra-orbital nerve should be divided with scissors, and the soft palate left as little injured as possible. Should any portions of the disease be left they may now be removed. All bleeding vessels are to be treated by ligature, torsion, actual cautery, or styptics, and the parts carefully brought together with interrupted sutures.

Fig. 200.

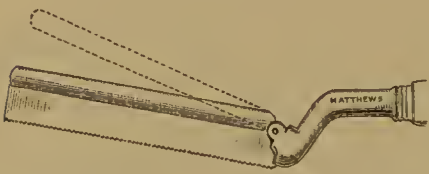
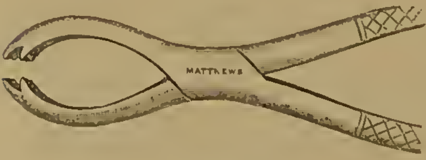


Fig. 201.



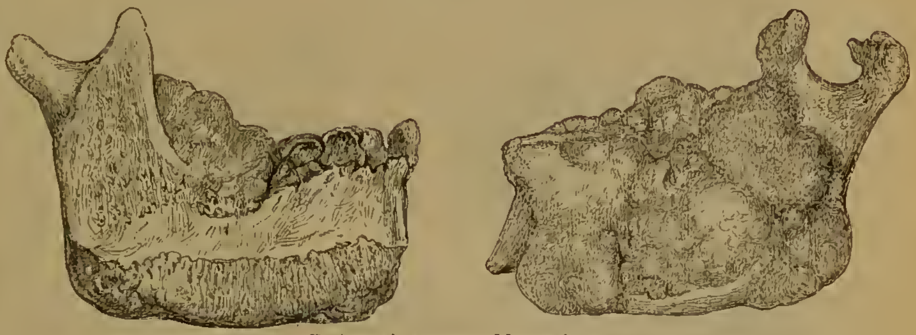
Lion forceps.

When the disease, says Heath, is of less amount, and the orbital plate is not involved, this should be preserved by carrying a saw horizontally below it; and if the palate is not involved this may be advantageously kept intact by making a similar cut immediately above it. Sir W. Fergusson, indeed, advises that the disease should be cleared out from the centre towards the circumference, so as not to remove healthy structures unnecessarily, and this may be readily accomplished by means of the many forms of curved bone forceps with which Surgeons are now familiar, aided by the gouge.

Tumours of the lower jaw. Varieties.

Tumours of the lower jaw grow to enormous dimensions, and pathologically they are very similar to those of the upper. The fibrous in one of its forms is probably the most common, the periosteal tumour being more frequent than the endosteal; the latter may occupy the dental canal as illustrated by a case of Mr. Cock's (Guy's Hos. Mus., 1091^{25}), in which the dental nerve passed through the tumour. The periosteal growth is often an epulis, and a good example of this form is represented in Fig. 188. But a more typical example of a true periosteal sarcoma which I removed in 1872, from a girl æt. 20, is illustrated in Fig. 202. The tumour had been of three months' growth. It returned three months after removal, and destroyed life by suffocation, having grown to the size of the patient's head. Microscopically the tumour was a spindle-cell periosteal sarcoma. One of the largest fibro-cellular tumours of the bone on record occurred in Mr. Heath's practice; it is illustrated, with his permission, in Fig. 203; it was removed from a man æt. 32, and the disease was of eleven years' growth. The tumour weighed 4 lb. 6 oz.; the man died on the sixth day from exhaustion.

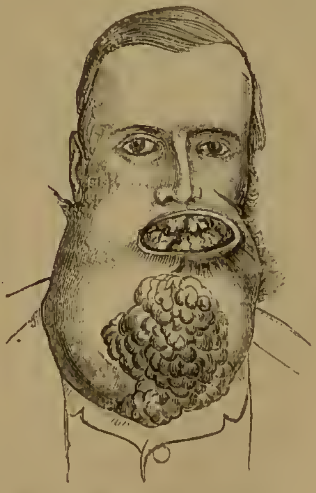
Fig. 202.



Periosteal sarcoma of lower jaw.

View of section. External aspect of tumour.

Fig. 203.



Fibro-cellular tumour of the lower jaw.
Mr. Heath's case.

Fibro-cystic tumours.

Fibro-cystic tumours of the lower jaw are very common, and they have the same clinical history and aspect as the cystic tumours to which attention has been directed. The most beautiful example on record is one that was removed by the late Dr. Hutton, of the Richmond Hospital, Dublin, and is illustrated in Heath's book; it was made up of cysts, and was of nine years' growth, in a young woman only 20. A more remarkable case still, however, was operated upon by Mr. Key in 1841, in a boy æt. 13 (Figs. 204, 205); the tumour was of two years' growth and painless; Mr. Key removed the whole by sawing through the lower jaw just below the angle on each side; a good recovery ensued.

Fig. 204.

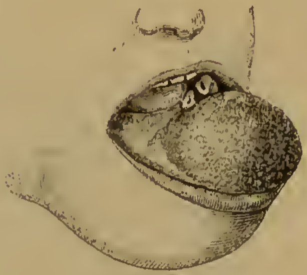
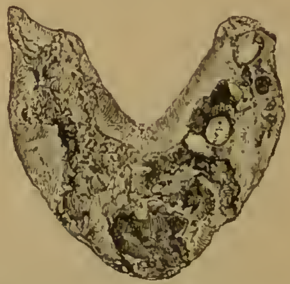


Fig. 205.



Fibro-cystic disease of lower jaw.

Guy's Hosp. Mus., Drawing 4^{57}. Key's case, during life.

Guy's Hosp. Mus., 1090^{50}. Key's case. Tumour after removal.

Cartilaginous growths. **Cartilaginous growths** are not very common; they occur in early life, and are as already stated periosteal and endosteal. A fine example of the latter is to be seen in 'Prep. 1091^{15} and ^{16}, Guy's Hosp. Mus., which Mr. Key removed in 1846, from a woman æt. 29, in whom the disease had been coming for nine years. In the preparation the fibro-cartilaginous substance is seen to be placed between the plates of bone of the jaw, the teeth being in the middle of the new growth. The periosteal tumour grows to a very large size.

Osseous tumours. **Osseous tumours** are sometimes the result of ossified enchondroma. In St. Thomas's Museum is a specimen of this kind which was removed by Mr. Cline. Bone may, however, occur as an independent growth in the form of cancellated or ivory exostosis, which may sometimes grow to a large size.

Cancerous tumours. **Cancerous tumours** are usually endosteal, and many are the cases on record of the affection; they are met with in children and adults, and are rarely of the hard kind of cancer. They are of rapid growth and soon break down, involving skin and all adjacent parts in the disease; indeed any rapid growth about the lower or the upper jaw should be suspected as being cancerous. Almost all benign tumours are of slow growth.

Treatment of tumours of lower jaw. TREATMENT.—Tumours of the lower jaw as of the upper are to be treated by excision, and as a large operation it is most successful. Thus Heath says that Mr. Cusack removed large portions in seven cases with only one fatal result, and Dupuytren operated in twenty with only one death. Sir W. Fergusson also tells us that his success has been very great; Syme's and Liston's success is well known.

When small. Small tumours of the jaw and particularly of the alveolus may be removed from the mouth with good cutting forceps, as may also many tumours involving the central portion of bone. Mr. Maunder, of the London Hospital, has recently done this operation with success. Should more room be required to manipulate in the mouth, an incision may be made outwards or downwards at the angle, and to facilitate the division of the jawbone a horizontal incision along the chin, and the dissection of the soft parts off the bone, will allow of the application of the saw.

When large. Operation of excision.

When a large tumour has to be removed it may be readily exposed by a curved incision carried along the posterior surface of the tumour from above the angle of the jaw to the median line, turning the soft parts back. In doing this the facial artery will be divided, and it should be at once secured at both ends by torsion; the knife, says Fergusson, may be so lightly carried over the artery that it need not be divided till the flap is being raised, thus saving blood. The labial orifice rarely need be divided, the incision should be stopped short of this margin. The tumour having been exposed its surface must be well examined with the view of the removal of the growth by cutting away the external plate of bone which covers it in; this may be done by means of the gouge and bone forceps; indeed this step may be looked upon as a wise one under most circumstances, particularly in doubtful cases, for a large number of tumours of the jaw, particularly the cysts, may be scooped out, and a good recovery ensue. Should the tumour and jaw have to be excised a tooth must be extracted in front, where the bone is to be divided and a small saw applied; the bone is then to be grasped with the Lion forceps and drawn outwards, the Surgeon carefully dividing all the soft parts that hold it in position on its inner surface, keeping the knife *close to the bone;* when the disease stops at the angle the saw and forceps are again to be applied and the tumour removed. Where disarticulation is required on account of the extension of the disease the jaw must be forcibly depressed so as to bring the coronoid process within reach, and allow of the division of the insertion of the temporal muscle. The condyle may then be twisted out, the knife dividing cautiously such ligamentous fibres as are put on the stretch. Fergusson says that in doing this he has found the condyle actually separated from the periosteum on its inner side, thus facilitating its removal, and of two cases of my own I found this to occur in one after the division of the periosteum with the knife. When the tumour is so large as to be wedged in and prevent this mode of dislocation, the best plan is to reapply the saw and cut off the tumour as high as may be, and subsequently to remove the remaining portion of jaw. When the central portion of the lower jaw is removed there is danger of the tongue falling back, and causing suffocation; to prevent this a ligature may be passed through the tip of the tongue and held, its end being on the completion of the operation fastened to the wound and divided on the second or third day.

When disarticulation required.

When central portion removed.

After the operation all arterial bleeding is to be stopped, a stream of cold water over the parts arresting any oozing, and the edges of the wound are to be brought together by interrupted sutures. Convalescence is generally rapid and recovery complete; the deformity following being so slight as not to be observed in many cases; the interval being filled in with dense fibre tissue. Bone is never reproduced, but the tissues soon become firm enough to bear the support of artificial teeth.

The half-sitting position is probably the best in all these operations on the jaws; chloroform may be given without fear. For more detail connected with this subject the reader may refer to Heath's admirable 'Monograph on the Jaws;' Fergusson's 'Surgery;' Liston's paper, 'Med.-Chir. Trans.,' vol. xx, and his 'Pract. Surgery.'

Disease of the articulation.

Disease of the temporo-maxillary articulation is rarely met with, indeed more rarely than disease of any joint in the body. I have seen two examples of it, one in a woman, æt. 34, who had had it for nine years, suppuration having existed for six. Several sinuses leading down to the joint were present, and the jaw was nearly fixed. Dead bone appeared to be present. The patient refused to have any surgical interference. The second case was a girl æt. 18, in whom both sides of the lower jaw were completely anchylosed. In Guy's Hosp. Museum there is also a splendid specimen, No. 1070, of complete synostosis of the articulation.

The cases already quoted of necrosis of the condyloid process of the lower jaw, and recovery with a sound joint, may here be referred to.

Closure of jaws.

Causes.

Closure of the jaws may be caused by some spasmodic condition of the muscles of the jaw secondary to disease of the teeth, or the cutting of the wisdom teeth; in the latter case the mouth must be forced open, under chloroform, by means of the screw gag or wedges, and the tooth removed, or, what is better, room made for it to come forward by the extraction of a neighbouring molar. It may likewise be caused by the contraction of cicatrices either within or without the mouth, or as indicated above by anchylosis. Dr. S. Gross, in his 'System of Surgery,' tells us that the former causes are the most common, and he attributes the majority to the evil practice of giving calomel to salivation. In rarer cases the immobility is occasioned by an osseous bridge extending from the lower jaw to the temporal bone, this condition being generally associated with chronic articular arthritis. However induced, writes Gross, the effect is not only inconvenient, seriously interfering with mastication and articulation, but it is often followed, especially if it occur early in life, by a stunted development of the jaw, exhibiting itself in marked shortening of the chin, and in an oblique direction of the front teeth.

Treatment of closure of jaws.

TREATMENT.—Where the cause is in the joint, and cannot be removed, as can dead bone, the Surgeon may attempt to break up the adhesions by forcibly opening the mouth under chloroform, or divide the bone below the joint. When due to cicatrices and nodular plastic matter, little good has ever been derived from their division. Esmarch, of Kiel, in a paper 'On the Treatment of Closure of the Jaws from Cicatrices,' 1860, has, however, described an operation for the formation of a new joint in these cases, his operation consisting in a removal of a piece of the lower jaw. Mr. Henry and Mr. Heath in this country have both put into practice Esmarch's operation, and the success has been enough to indicate its great value. It must be mentioned that about the same year Rizzoli, of Bologna, performed a somewhat similar operation to Esmarch's, dividing the jaw but not removing any portion.

Operation of removal of piece of jaw.

Operation.—This may readily be done by making an incision along the lower border of the jaw, in front of the masseter, and raising the integument, completing the operation by removing a wedge of bone, measuring about an inch above and a half below, with a hand or chain saw. Where only one side of the jaw is affected it is without doubt the best operation to be performed, the patients recovering their masticatory power in two or three weeks.

Deformities of the jaws.

Deformities of the jaws are sometimes seen as a consequence of some disease of the tongue, such as hypertrophy; the mechanical pressure of tumours during its growth; the evil influence of cicatrices, more particularly about the neck and mouth, and other causes. For these surgery may often do much, and when this fails the dentist can give relief. I have seen the upper jaw in two cases of torticollis nearly one inch less in its vertical diameter than on the opposite, and I have already alluded to a case where the lower jaw was nearly an inch higher than natural, to make up for a deficiency in the teeth of the upper jaw which had existed from childhood.

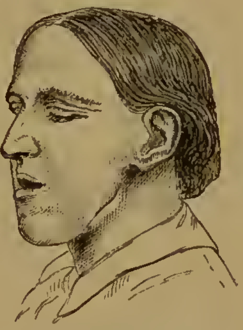
Dislocation of the Jaw.

Dislocation of the jaw.

Varieties and causes.

This may involve one or both condyles, two out of every three cases being bilateral. It may be caused by direct violence upon the jaw, but more frequently by yawning. Sir A. Cooper tells of a case in a child where it was produced by the forcible introduction of an apple into the mouth, and dentists know of its being produced by the extraction of a tooth.

FIG. 206.



Dislocation of lower jaw.
Couper's case.
'London Hosp. Rep.,' 1864.

Symptoms of double dislocation.

In the *double* dislocation the mouth is widely open, the jaw fixed and projecting, the lips separated, and, as a consequence, speech is very difficult. Deglutition is much interfered with, and the saliva flows from the open mouth. In front of the ear a marked hollow will be perceptible, and *above* the zygoma in the temporal fossa, an undue prominence (Fig. 206). Adams, of Dublin ('Dub. Quart. Journ. Med. Science,' vol. i), first noticed these symptoms, and Dr. R. W. Smith ('Fractures,' 1854) believes them to be caused by the "displacement and stretching of the fibres of the temporal muscle on the upper surface of the condyle."

Single dislocation.

In the *single* dislocation the chin is oblique, but usually directed towards the *sound* side instead of towards the *injured* side, as in fracture of the neck of the bone. In exceptional cases, however, this is not to be observed. The other symptoms are similar to those of double dislocation, the hollow in front of the ear being the most characteristic one.

Congenital dislocations.

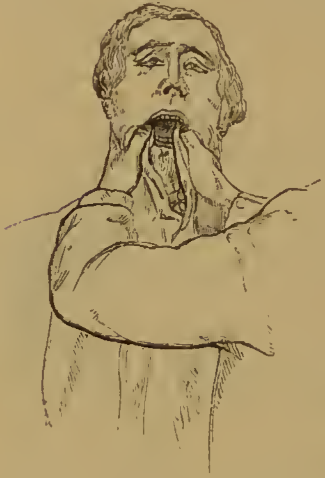
Congenital dislocations have been described by Smith, Guerin, Langenbeck, and Canton. Sir A. Cooper has also drawn attention to *subluxation*, in which he assumed that the condyle of the jaw slipped in front of the interarticular fibro-cartilage. It is caused and characterised by the same conditions as the cases of dislocation, and it is probably a partial dislocation forwards.

Reduction of dislocations.

Mode of proceeding.

TREATMENT.—Partial dislocations, or those described as subluxations, are usually reduced by the patients themselves, by some little lateral movement of the jaw or by gentle pressure upon the chin. Cases of complete dislocation have likewise been similarly reduced; more frequently, however, the Surgeon's aid is demanded. The patient should be placed in a chair with his head supported, and the Surgeon should stand in front. The operator, having well protected his thumbs with a towel or lint, may then introduce them into the mouth, and with the thumbs upon the last molar teeth he should firmly grasp the jaw. Pressure should then be made upon the teeth downwards and backwards so as to depress the condyles from their false position, at the next moment elevating the chin with the outer fingers; by these means reduction is readily effected (Fig. 207). Some Surgeons prefer using a piece of wood or the handle of a fork to depress the jaws. When strong leverage is required, as in old cases, Stromeyer's forceps may be employed. It is well to reduce both sides together; old standing dislocations may be thus reduced. Mr. Morley reduced one after thirty-five days; Spät after fifty-eight; Demarquay after eighty-three, and Donovan one after ninety-eight. (Heath.)

Fig. 207.



Reduction of dislocation of lower jaw.

Fractures of the Jaws.

Fractures of the upper jaw.

Causes.

When the *upper jaw* is broken it is generally from direct violence, and when the "Key" was employed for the extraction of teeth a fracture of the alveolus was frequently met with. In severe injuries much displacement may take place, and copious hæmorrhage follow; indeed cases are on record where the internal maxillary artery was ruptured and a fatal result took place. At times the infra-orbital nerve or its branches are injured, when some loss of sensation in the cheek will be produced. I have known emphysema of the cheek to follow such an injury, and have seen subconjunctival hæmorrhage indicate it. One of the worst examples of fracture of the upper jaw I have seen occurred at an asylum from the direct blow of a lunatic's fist. In this case the whole of the alveolar process of the right upper jaw was broken off, and the lower jaw fractured in two places.

Treatment.

TREATMENT.—Where *no* displacement has taken place little treatment is called for; the parts are to be left alone and natural processes will effect a cure. When *displacement* exists and can be remedied by manipulation such means should be applied, some slight retentive bandage with or without a pad being employed to keep the parts in position; when the palate plate is much interfered with and displaced, the dentist's aid may be called into requisition, a gold plate well adapted to the parts tending to keep the fragments together; *vide* Salter, 'Lancet,' 1860. Hæmorrhage, as a rule, can be arrested by the application of ice or styptics. When the soft parts are injured and bleeding takes place from them the vessel should be secured.

When comminuted.

When the bone is comminuted there is no need for the removal of fragments; Malgaigne laid this down as a law, and all Surgeons now follow it, while Hamilton asserts that, owing to the extreme vascularity of the bones composing the upper jaw, the fragments have been found to unite after the most severe gunshot injuries. In rare cases of separation of the maxillæ, says Heath, a spring passing behind the head and making pressure upon the maxillæ after the manner of Hainsby's harelip apparatus might be advantageously employed.

Fractures of the lower jaw. Generally compound.

Fractures of the lower jaw like those of the upper are as a rule the result of direct violence, and when produced by gunshot injuries are at times most severe. They are almost always compound, that is, towards the mouth, the gum tissues readily giving way. The body of the bone is more frequently broken than any other part, although the ramus and the neck of the jaw may be fractured. The line of fracture is generally oblique and is very commonly near the canine tooth. Double fractures are very common, eleven out of twenty-four cases recorded by Hamilton being of this nature. Comminuted fractures are more rare. A case came under the care of Mr. Poland at Guy's in which the jaw was broken in five places by the kick of a horse. The symptoms of fracture are generally very clear, crepitus being often felt by the patient in attempting to move the jaw, and readily made out by the Surgeon; the irregularity of the teeth is a very characteristic symptom, and the care of the patient to hold the parts in position taken with his inability to speak is a typical sign. Should any doubt exist as to the presence of a fracture the mobility of the broken bones will disperse it; great displacement sometimes complicates the case, the position and the line of fracture determining this point; an oblique fracture near the insertion of a large muscle, as the masseter, necessarily showing a tendency to override. In double fracture of the body of the bone this displacement is usually very marked, the muscles connecting the lower jaw with the hyoid bone drawing the lower portion down. In some cases this displacement cannot be completely remedied.

Symptoms.

Fractures of the neck of the jaw.

Fractures of the neck of the jaw are always the result of direct violence, and are not very readily made out; pain aggravated by any attempt to move the jaw is a constant symptom, and crepitus perceived by the patient. "The condyle," says Heath, "is drawn inwards and forwards by the pterygoideus externus, as can be ascertained by passing the finger into the mouth, and the jawbone is apt to become slightly displaced, so that the chin is turned towards the affected side and not from it, as is the case in dislocation." I have had under care a man, æt. 35, who has had a fracture of both sides of the jaw, just below the condyles, with fracture of the symphysis; it was produced by a severe blow upon the jaw below the chin, and from the displacement that followed the House Surgeon thought it was a case of double dislocation; on attempting to reduce it, however, it went in without the characteristic snap of dislocation. Ostitis and necrosis of the whole bone below the necks followed; but a new jaw formed, and the man recovered with good movement of the bone.

Fracture of the coronoid process is very rare; Sanson says such a fracture never unites.

Treatment of fractures of lower jaw.

TREATMENT.—When the bones can be brought into apposition the treatment may be described as simple; where difficulties are met with in reducing the fracture, the treatment is most difficult and uncertain. In an ordinary case of fracture of the jaw, where no displacement, or very little, exists, the common four-tailed bandage, a yard long, with a slit in the chin piece of about four inches, made and applied as illustrated in Fig. 208, is all that is required for temporary purposes, but for permanent treatment it is well to mould on a splint of gutta percha, made according to the shape given below (B), and applied as seen in Fig. 209, A. When healthy teeth are present at the line of fracture they may be fastened together with wire, after the method of Hammond's splint (Fig. 212).

FIG. 208.

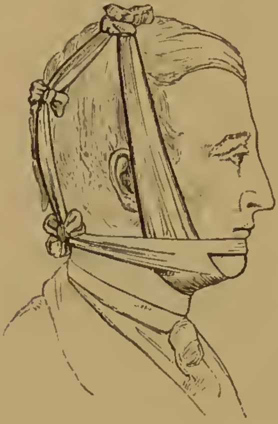
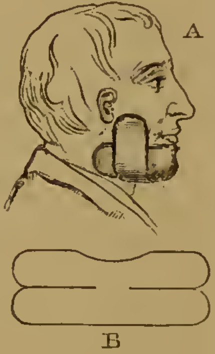


FIG. 209.

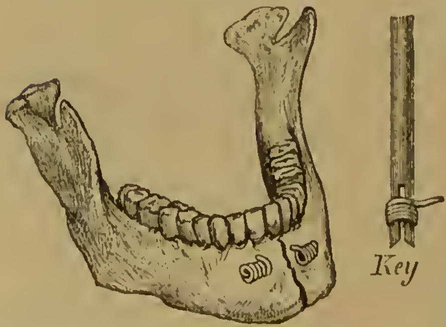


Bandage and splint for fracture of lower jaw.

When difficulties are felt in the adjustment, as in double fracture, where the chin is much drawn down, a good pad may be firmly tied under the chin, or a block of wood adjusted. In one case I fixed a plaster cast, holding the jaw well in position by means of a piece of linen during the setting of the plaster. But in these cases the Surgeon's ingenuity is often taxed to the utmost to meet the wants of the individual case.

On use of sutures.

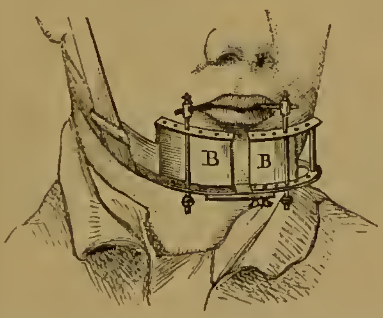
FIG. 210.



Thomas's mode of adjusting fractures of the lower jaw with wire and key.

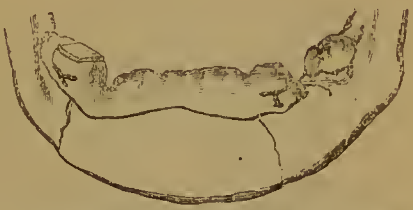
Some Surgeons have suggested that the bones should be fastened together by sutures when all other means fail, and Mr. Hugh Owen Thomas, Surgeon, of Liverpool, has published some cases to illustrate the practice, Mr. Thomas applying the wire ligature after the fashion illustrated in Fig. 210. He uses a 1-24th inch silver wire, and fixes it with a key (Fig. 210). ('Lancet,' 1867, and pamphlet, 1875.) In the case of comminuted fracture already alluded to, two or three wire sutures were applied with the best results. Others advise the use of wedges of cork, so adjusted between the teeth as to maintain the jaw in its right line. Hamilton speaks highly of gutta percha moulded to the teeth and gums within the mouth, and Tomes has invented a silver cap to fit the teeth for some distance on each side of the fracture. Barrett carries out the same idea in vulcanite. Berkeley Hill's modification of Lonsdale's apparatus is a good one, and Moon's splint as made for him by Millikin is excellent. It has the advantages of all the other interdental splints already enumerated; is readily adapted to a jaw of any size, and being introduced separately it is easily applied and can be readily removed when desired without shifting the cap which fits the teeth on either side of the fracture. Moon's splint therefore seems to be the best interdental one we possess, and it should be used when other simpler forms are inapplicable (Fig. 211). Moon's splint.

Fig. 211.



Moon's interdental splint made in two halves, BB, with horizontal rods to keep cap, Fig. 211a, in position.

Fig. 211a.



Metal cap fitted over fractured jaw. Represented as wired on for a time, after the withdrawal of external splint.

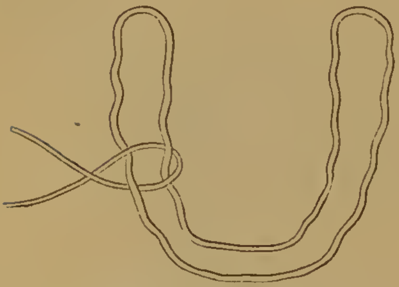
Amongst these simpler forms I must class "Hammond's," which I had brought before my notice during the year 1874 by Mr. Moon. It seems a very simple and valuable splint for the general treatment of fractures of the jaw. In all the cases to which I have had it applied it answered admirably.

The following description of the apparatus and its application I give in Mr. Hammond's own words:—

"I first place the patient in as convenient a position as circumstances will permit, then direct him to rinse the mouth with alcohol and water largely diluted, (which not only cleanses the mouth but removes the fœtor of the breath. I next bring (temporarily) the broken ends into approximation by passing a silk thread between and round the two teeth on each side of the fracture, and then secure by tying in front. Then with a suitable tray and very soft wax I take an impression of the teeth, to which, after its having been cast in plaster of Paris, I adjust a frame of iron wire (Fig. 212), which can be done with a pair of small curved pliers. When all is ready I slip the frame over the teeth in the mouth (Fig. 212a), and while it is held in position by an assistant, proceed to tie by passing small lengths of thin iron binding wire after the manner shown in Fig. 212, twisting them in front, until each ligature is nearly tight, turning the ends on one side until they are secured. Next, with the aid of an assistant I twist the wires Hammond's splint.

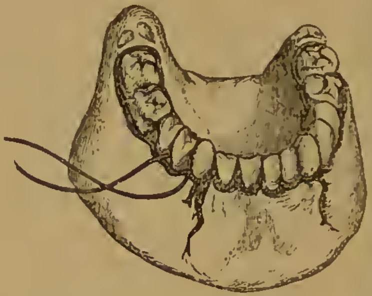
quite tight, working alternately each side of the mouth, so as to exert an equal pressure, and thus bring the bone into a natural position, also

Fig. 212.



Hammond's wire splint for fracture of the jaw.

Fig. 212a.



Hammond's wire splint applied to fractured jaw.

taking care not to overtwist or break them. I then cut off the ends and turn them in between the teeth. Now the jaw will be found comparatively firm, so solid, indeed, that the patient can bite steadily on it without pain. All that now remains to be done is to secure the jaw perfect rest by the four-tailed bandage." ('Monthly Review of Dental Surgery,' May, 1873.)

The frame should be worn for six weeks.

DENTAL SURGERY.[1]

General Remarks on Dental Surgery.

Dental Surgery, in its manipulative details, must necessarily, for the most part, be left to those who make its practice a speciality, but some acquaintance with affections of the teeth, and with the principles on which they are treated, is required by every one who is engaged in the practice of medicine or surgery; for without such knowledge he will be unable to advise his patients on the preservation of their teeth (a subject of importance as regards their general health), or save them from the sometimes serious local complications which may attend tooth disease. Nor will he be able to diagnose the true nature of certain tumours and cysts of the jaws, or to attach the proper importance to the teeth as the possible cause of neuralgia of the head and face, and of more remote nervous affections.

In the following pages only a sketch of this branch of surgery is aimed it, and the reader is referred for details to the excellent 'Dental Surgery' by the Messrs. Tomes, and to the interesting pages of Mr. Salter's work, 'Dental Pathology and Surgery.'

The various parts of our subject may, with advantage, be discussed in two main divisions. In the first section will be considered the defects in structure and abnormalities in form which may arise during a tooth's development, together with irregularities in its placement. In the second section will be considered the diseased conditions to which a fully formed tooth is liable, after it has assumed its destined position in the mouth.

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[1] For this section I am indebted to my colleague, Mr. Moon.

The effect which disease or malposition of a tooth may have on the structures immediately around it, and on the general health, will also be noted.

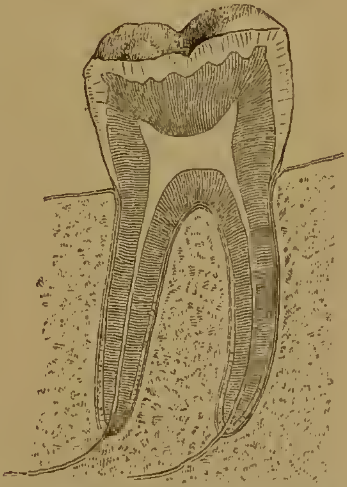
That a clear idea of these subjects may be obtained, some points in a tooth's development, structure, and connection with surrounding parts, must be borne in mind.

Description of a Tooth—its Development and Connections.

The relation of the several tooth structures to each other.

A perfected human tooth (*see* accompanying illustration, Fig. 213) may be described as consisting of an unyielding case of dentine or ivory, enclosing a highly sensitive vascular pulp; the portion of this case that forms the crown of the tooth is protected by a covering of an extremely hard substance, "enamel," which, becoming lessened in thickness as it extends down the sides of the crown, finally terminates at the neck of the tooth; the portion of the case that forms the root or roots is covered by "crusta petrosa," or tooth bone, and is implanted in the alveolar portion of the jaw; the crusta petrosa is covered externally by a sensitive and vascular membrane, "the alveolo-dental membrane," or "periodontum;" this membrane invests the root of the tooth and lines the bony socket, and is besides intimately connected with the dentinal pulp at the apex of the root, and with the gum also where the latter structure encircles the neck of the tooth.

FIG. 213.



Represents a vertical section through a lower molar tooth, showing its different component structures, and its connection with parts around.

Vascular and nerve supply.

Implantation.

Through the foramen at the end of the root blood-vessels and nerves pass for the supply of the dentinal pulp, while other nerves derived from the same source (viz. the second division of the fifth in the case of the upper, and the third division in the case of the lower teeth) are distributed to the alveolo-dental membrane. The teeth are implanted in the alveolar process of the jaw, which is developed with them and is reabsorbed when they are lost.

Development.

Development.—The twenty developing temporary teeth, enclosed in their respective sacs, are contained in the jaws at the time of birth, as are also germs of the permanent molars and those of the anterior permanent teeth; these latter, receding from their position near the surface of the gums and becoming encapsuled, gradually pass down in the rear of the temporary teeth and remain embedded in the jaw, developing at leisure within their bony crypts until wanted to replace their more fragile predecessors. (*See* Fig. 215.)

Shedding of temporary, cutting of permanent teeth.

The following is the normal process attending the eruption of one of the anterior permanent teeth. The roots of the antecedent temporary tooth having been absorbed, its crown is shed, and the new tooth then gradually uprises from the gum—the protrusion of its crown taking place simultaneously with the continued elongation and development of its root.

Diagram showing the structures involved in dentigerous cyst and odontome formation.

FIG. 214.

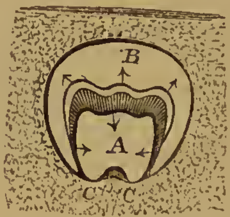


Diagram of developing lower molar tooth.

A. Dentinal pulp becoming centripetally encased by dentine.
B. Space occupied by enamel organ between centrifugally forming enamel and tooth sac. In this space fluid collects in the formation of a dentigerous cyst.
C. C. The base of dentinal pulp which remains attached and developing until the tooth is completed. By abnormal outgrowth at this point a radicular odontome would be formed.

Development.

The development of a permanent tooth thus occupies many years. Take, for examples, the first permanent molar and central incisor, the teeth which are the first developed of the permanent set. Their pulps commence to take form during fœtal life, their calcification commences by birth or in the first months of infancy. Their eruption takes place from the sixth to the eighth year, and their root canals with their terminal foramina are not reduced to their ultimate dimensions for two or more years later.

The three hard structures which enter into the composition of a tooth have distinct sources of origin. (*Vide* Diagram, No. 214.)

Enamel, dentine and crusta petrosa—their distinct sources of origin.

The enamel developed from the "enamel organ" of epithelial origin (which occupies the space B in the accompanying diagram) is formed *centrifugally* on the coronal dentine, and through the obliteration of its formative organ becomes on the eruption of the tooth incapable of further growth or nutritional change.

The dentine is developed from the "dentinal pulp" of vascular connective tissue (*vide* Diagram 214, A) by the immediate agency of a superficial layer of cells called odontoblasts.

The dentinal pulp or bulb, arising from the bottom of the tooth sac, and projecting into its interior, grows up beneath the enamel organ and progressively takes the destined form and dimensions of the dentine just prior to the formation of that structure; thus, the free end of the bulb, having taken the form of the cutting edge or masticatory surface of the future tooth, becomes capped by dentine, which forms on it from without inwards; and this crown cap being formed, the remainder of the tooth is developed by the gradual growth of the pulp at its attached surface or base (*see* Diagram 214, C, C) and its subsequent encasement by dentine. In the fully developed tooth the pulp comes to occupy a comparatively constricted central chamber corresponding in form

Tooth pulp.

pretty accurately to the external contour of the tooth, and this chamber may be yet further diminished in size by a renewal of the centripetal growth of dentine.

Connection of periphery of dentine with pulp.

Dentine, remaining as it does in connection with its formative organ through the medium of the tubuli of which it is mainly built up, is capable of a certain amount of increased solidification even at its periphery, and under certain conditions is endowed with most acute sensitiveness.

The crusta petrosa is formed on the gradually elongating root through the agency of the dental sac or capsule which surrounds the forming tooth crown and ultimately comes to invest the root in the form of the fibro-vascular, "alveolo-dental membrane."[1]

The alveolar portion of the jaw grows up with and is moulded around the developing teeth, and when their crowns erupt it affords them firm implantation, by closely surrounding their roots.

Having thus far traced a tooth's development, we now pass to the consideration of the effects which follow departures from this normal process.

Odontomes.

"Odontomes."

Tumours which result from the abnormal and excessive development of the dental structures at any time during the tooth's formation have been grouped together by M. Broca under the name of Odontomes,[2] and classified by him as follows:—

Varieties.

I. **Odontomes embryoplastiques.**—Those which arise before the dental pulp has developed odontoblasts, and before the enamel organ has acquired special enamel-forming cells.

II. **Odontomes odontoplastiques.**—Those which arise after the special dentine and enamel-forming cells have been developed, but prior to the formation of the coronal cap of dentine.

III. **Odontomes coronaires.**—Those which arise while the crown is forming.

IV. **Odontomes radiculaires.**—Those which arise during the formation of the root.

These four designations, pointing respectively to the periods in the tooth's development at which the hypergenesis of the pulp has arisen, also indicate to a certain degree the structural formation of a tumour formed at either period; but in adopting these terms it must be understood that, in one sense, the embryoplastic and odontoplastic conditions are present consecutively during the whole period of dentification, and also that if the odontoblast layer of cells is destroyed at any point, true dentine will not there be formed, although the pulp may undergo calcification, resulting in a kind of osseous structure.

Embryoplastic odontomes.—Under this name M. Broca ranges encysted fibrous and fibro-plastic tumours of the jaw. As the dental germ at the time of their origin contains no special dentine and enamel-forming cells, distinctive dental structures would of necessity be absent from these growths, and such absence must of course leave their dental origin in doubt.

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[1] From the dental sac is also probably derived the membrane known as the "cuticula dentis," or "Nasmyth's membrane," which in an unworn tooth is found continued over the crown, and is regarded by C. Tomes as an undeveloped cemental layer.

[2] Exostosis of the root and "dentine excrescence" in the pulp chamber are called by Mr. Salter "secondary odontomes," and naturally come under that designation, as might also the outgrowth of the pulp which sometimes follows the exposure of that structure; but as these are affections of the fully developed tooth, they will be considered in the second division of our subject.

Cases which render probable M. Broca's views on the dental origin of many jaw tumours.

In one instance (mentioned by Tomes) M. Robin met with a tumour in the lower jaw of a child, æt. 2½ years; this tumour, apparently fibrous, was studded with papillæ, on which distinct dentine and enamel were found. Now, whatever doubt may arise as to the origin of the before-mentioned tumours, there can be no doubt as to the dental origin of this one, and it is probable that in it a longer existence would have been accompanied by further dentification. In another odontome, which occupied half of the lower jaw of a girl æt. 2 years and 9 months, M. Broca found the formation of dentine proceeding at numerous points, and the fusion of these secondary bulbs, coated as they were with enamel organ, would result in bringing about the structural conditions found in a fully developed (diffused) odontoplastic odontome.

Odontoplastic odontomes.

Odontoplastic odontomes, in outward form, may bear not the slightest resemblance to a tooth (and may then be called diffuse).

Structure.

Structurally they consist of a more or less confused mass of dentine, enamel, and osseous structure; the dentine occurring in tracts, between which the enamel has dipped down. Enamel is also found capping nodular projections which occur on the surface.

The case met with by Dr. Forget and reported by him may be cited as an example. A man æt. 20 presented himself with disease of the lower jaw, from which he had suffered since he was five years old; on looking into the mouth a hard smooth tumour was seen occupying nearly the whole of the left side of the lower jaw. None of the teeth beyond the first bicuspid were present. On removal (by section of the containing bone) this tumour proved to be a hard, oval, tuberculated mass, the size of an egg, chiefly composed of dentine, with enamel investing the nodules and dipping into crevices. Between the tumour and the osseous crypt which it occupied, there was a thick fibro-cellular membrane. The forming second bicuspid tooth and the crown of a molar were found impacted in the jaw through the superposition of this mass.

Origin.

The bulbs of one or more teeth, normal and supernumerary, may enter into the formation of one of these tumours, and surrounding teeth in various stages of development may become enclosed by it.

Malignant tumour simulated.

In one instance reported and figured by Tomes, a large tumour, presenting the appearance of a malignant growth, occupied the incisive region of the upper jaw of a man aged 25, his four upper incisors not having appeared. A probe introduced into the tumour impinged on something hard, which proved to be sundry masses of tooth structure, best described as odontomes, together with some ill-formed teeth. These specimens, numbering in all fifteen, are in the Museum of the Odontological Society of London, and the case may, perhaps, be best described as one of disrupted odontoplastic odontome.

Spontaneous enucleation.

In a case reported by the late Mr. Harrison, an odontoplastic odontome, occupying the space between the incisors and molar teeth, came away spontaneously.

In one or two reported cases the tooth bulb having produced an eccentric formation such as described, instead of an ordinary crown, has afterwards assumed normal limits and formed fairly shaped roots.

Coronary odontomes.

Coronary odontomes.—In these the main outline of the tooth is preserved, but an irregular outgrowth more or less circumscribed projects from the crown. This outgrowth, having arisen while the crown was in process of formation, consists of the coronal tooth structures, enamel, dentine, and possibly enclosed pulp. If small and involving the neck of the tooth, an outgrowth of this nature may be at first mistaken for tartar.

Structure.

Allied malformations.

Somewhat allied to these cases, are those in which a tooth presents one or two supernumerary cusps or supernumerary teeth merged with it.

A small globular projection of enamel is also occasionally met with on the root of a tooth, and has been ranged among odontomes by Salter, who, finding that it caps a cone of dentine, calls it "a submerged tooth cusp." The crown of a simple supernumerary tooth has been found attached in the same position, and probably these cases have a like origin.

Radicular odontomes.

Radicular odontomes.—In several recorded cases when the crown of a tooth has been completed and the root has been in process of formation, an irregular outgrowth of the pulp has given rise to a tumour as large as a chestnut.

Structure.

Nature of odontomes.

Structurally a radicular odontome may consist in varying amounts of dentine, osteo-dentine or calcified pulp, and cementum. The structure which in these tumours has been looked upon by various authors as cementum is doubtless, as pointed out by Salter, due to a calcification of the hypertrophied dental pulp, the irregular outgrowth of which organ may be said to originate odontomes—enamel and cemental formation only following its vagaries.

Radicular odontome of unique form.

In the case which is figured and reported at page 516 of this volume, Fig. 191, a symmetrical enlargement of the whole root occurred, producing a dilated hypertrophied tooth fang.

Supernumerary teeth possible cause of dental tumours.

Odontoplastic and radicular odontomes are very rare, only a few cases of each in the human subject being recorded, but the recognition of the true nature of these tumours and of others which have a dental origin is of course of the highest importance, as it will avert an unnecessarily severe operation for their removal. In the case of tumours and cysts of the jaws the undue absence of any tooth will point to the probability of their dental origin, but the possibility of such origin would not be excluded if the normal number of teeth were present, as a supernumerary tooth may originate either an odontome or a dentigerous cyst.

A glance at the close packing of teeth in a child's jaw, as shown in Fig. 215, will show the strong probability of a dental origin for tumours and cysts of the jaws in young subjects, especially when it is remembered that each of the forty-eight teeth to be seen in such jaws at one time, is, or has been, the centre of developmental activity; the likelihood also that tumours may cause involvement or displacement of neighbouring teeth will be readily realised.

Fusion of teeth within common capsule.

Gemination, or the union of contiguous teeth, due to the fusion of their pulps, is met with occasionally in both the temporary and permanent sets. Normal teeth may be thus joined, or normal and supernumerary.

Dilaceration.

Dilaceration, or the abrupt change in the direction of the first and last formed portions of a tooth, sometimes occurs, and is due to a shifting of the forming tooth on its base.

Dentigerous cysts are cysts formed by the accumulation of fluid

Dentigerous cysts.

within the dental capsule at some period of the tooth's development, or around a fully developed tooth which has not erupted. They may therefore advantageously be classified, like odontomes, according to the point to which the tooth's development has proceeded, when the change occurs which eventuates in their formation.

Nature of.

When fully developed, a dentigerous cyst usually consists of a thick membranous sac, covered in by a thin osseous shell, formed by the expansion of the bone of the jaw. In a case met with by Mr. Fearn one half of the lower jaw was expanded by a cyst which separated its external and internal plates. The cyst wall itself in some instances has been found calcified. The cyst at first usually contains a serous fluid, which may become purulent through the occurrence of inflammation.

Dentigerous cyst of odontoplastic period.

Antral involvement.

The uncut tooth (temporary, permanent, or supernumerary) about which the cyst has expanded, may be represented by a small shapeless, calcified mass, if its formation was disturbed in the embryoplastic or earliest odontoplastic periods. This fact was well exemplified by the case of a girl aged 13, who was recently at Guy's, under the care of Mr. Cooper Forster, and the same case was also a good example of the fact that dentigerous cysts forming in the upper jaw are apt to expand into and cause distension of the antrum. Professor Baum met with a case of immense dilatation of both antra, one containing a molar, the other a canine. The enclosed tooth may be attached firmly to the cyst wall, or may be found free within the cyst.

The following case was reported by Mr. McCoy, in the 'Lancet' (1871) and is quoted by Tomes. A boy, æt. 14, had a tumour of the antrum, the size of an apricot, due to an impacted canine, the crown of which projected into the antral cavity, while the root was implanted in a socket in the nasal process; the antral cavity contained a little glairy fluid, but was chiefly filled by a gelatinous substance, apparently thickened mucous membrane. If the condition of the antrum here described was not produced simply by the abnormal presence of the tooth crown, this case would prove (coupled with other recorded cases of cystic expansion around the crowns of teeth about to erupt) that a dentigerous cyst may be formed by the dilatation of the capsule surrounding the crown of a tooth, the root of which remains implanted and covered with alveolo-dental membrane.

In some cases the tooth crown only, or the crown and part of the root, have been formed prior to the expansion of the capsule by serum, and these may be said to belong to the coronary and radicular periods. In other cases, again, the cyst developes around fully formed impacted teeth, which may be found inverted. In one instance mentioned by Tomes, no less than twenty-eight separate and adherent denticles (or small supernumerary teeth) were found in a cyst of the upper jaw, and are probably to be looked upon as the elements of teeth that were missing.

Early origin.

Gradual development.

Although both odontomes and dentigerous cysts have their origin in "early life," years may elapse before the irritation caused by the presence of the odontome, or the increasing disfigurement and pain resulting from the enlargement of a dentigerous cyst, may lead a patient to seek surgical aid.

Cysts developed on the root of erupted and fully formed teeth are not classed here as *dentigerous*, as they form only an appendage to the tooth. They will be referred to among the diseases of the teeth, but it may be here remarked that they sometimes attain to a large size and may, like dentigerous cysts, expand into the antrum, and also that their contents under inflammation may become purulent.

Supplemental teeth.

Supplemental teeth (*i. e.* extra teeth exactly corresponding to a neighbouring normal tooth) are occasionally developed in both temporary and permanent sets, usually in the front of the mouth. If they cause crowding or are placed before or behind their doubles, they should be extracted.

Supernumerary teeth.

Supernumerary teeth (*i. e.* teeth differing in form from any of the normal series) are not infrequently found in the upper incisive region and occasionally in other parts of the mouth. A pair of teeth somewhat resembling incisors, but of greater antero-posterior depth, and with a deep pit on their lingual aspect, are occasionally developed behind the permanent upper front teeth, and others more resembling small molars or bicuspids are also occasionally met with, but by far the commonest form that the crowns of supernumerary teeth present is that of a simple cone, or of a cone truncated and pitted on its summit, and these teeth have a characteristic straight terminal line to the enamel at their necks; they are, in fact, the most elementary form of tooth formation.

Treatment.

As a general rule, supernumerary teeth are to be extracted and will always be found to have a single root.

Syphilitic teeth.

Malformed teeth.—Teeth in different individuals present considerable variations in size, depth of natural fissures, &c., but passing over these (so to speak) accidental differences, we come now to consider malformations which arise from a specific cause, and which may be of great value in diagnosing a patient's constitutional peculiarities. Mr. Hutchinson first pointed out the association between congenital syphilis and a mis-shapement of the permanent teeth. This malformation is generally most strikingly apparent in the incisor teeth, the upper centrals presenting the shape, diminution in size, and often the slight change in direction shown in Fig. 214A, instead of the normal condition represented in Fig. 214B. These dwarfed teeth present differences of form, but the most characteristic change in them is their lessened breadth at the cutting edge as compared with that of their necks, the vertical groove on their anterior face being often absent, and the notch on their cutting edge not being an absolutely constant feature. The lower incisors usually present a corresponding shape, and the other teeth may have their corners rounded off, and in the case of the canine be notched. The shape of the first permanent molars is almost invariably altered (a fact, I believe, not hitherto pointed out), the suppression of their angles giving them a dome-like form, their size being often reduced, and the enamel absent from their masticatory surfaces.

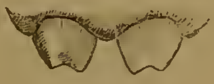

FIG. 214A.

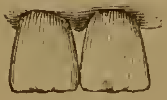

FIG. 214B.

The above-described malformation is essentially due to a change in form of the dental pulp prior to its dentification.

A rounding-off of the angles of one or other of the molar teeth (1st, 2nd, and 3rd) has been noticed by the present writer in patients who have been the subjects of convulsive seizures about the time when these teeth were respectively in course of development, and this in cases where there was no evidence of congenital syphilis. As this fact may prove to be of importance, it is here mentioned, though further observations are required on the subject.

Syphilitic teeth quite distinct from the honey-combed.

The syphilitic tooth with its conical form is by no means to be confused with the teeth which present a narrowness of their cutting-edge due to an absence of enamel from the first-formed portion of the crown, a condition often seen in the so-called honeycombed teeth now to be noticed.

Honey-combed teeth.

Causes.

The rocky or honeycombed condition of a tooth's crown results from an irregular and insufficient development of enamel, producing horizontal groovings or a pitting of its surface. Its chief cause, Mr. Hutchinson thinks, is the administration of mercury, given for infantile convulsions, congenital syphilis, or on other accounts, but it is by no means clear that convulsions and other illnesses in childhood may not produce it.

The first permanent molars on their masticatory surface most often show the absence of enamel, while the incisors and canine are affected to an extent which depends on the amount of their development while the agency which arrests the enamel formation is in action; the later formed bicuspids, second molars, and wisdom teeth, often altogether escape.

The irregularly formed enamel may be structurally defective, as shown by its discoloration, and this may conduce to decay, as does also the pitting of the enamel if it extends through to the dentine. In other cases the diminished size of these teeth, which prevents their being crowded and exposes their sides to healthful friction, renders them less obnoxious to decay than might have been expected.

Imperfections in Structural Development.

Structural defect conducing to decay.

Malnutrition.

At the present day the early decay and loss of teeth is very common, and is probably in part due to an insufficient supply of food containing the elements which go to build up the osseous structures,[1] malnutrition in early life, from whatever cause, leaving inevitably its mark on the exteriors of the teeth, which, once ill formed, have no power of recuperation.

Structural defects in enamel development.

Sound enamel.

Perfected enamel contains upwards of 95 per cent. of earthy matter, and consists of rods united together without intervening matrix, and placed at right angles to the surface of the dentine. Enamel, when well formed, is semi-transparent, but when defective from a want of homogeneousness in its structure it presents an opaque white, chalky appearance, and is then easily disintegrated. At the bottom of the natural sulci of otherwise well-formed teeth enamel is sometimes deficient in thickness and in soundness, and this favours the ingress of decay.

Defective enamel.

Structural defects in dentine formation.

Dentine.

Well-formed dentine is uniformly dense and ivory-like. It is built up of tubuli and intertubular substance, the tubuli serving to convey nutrition from the pulps to the periphery. Dentine is endowed with sensitiveness through nerves (probably too small for demonstration), which pass from the pulp to the surface and render the dentine immediately beneath the enamel especially sensitive.

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[1] In infancy and childhood plenty of good milk and the use of "*whole* flour meal" are to be recommended; it is to be borne in mind that until a child begins to take animal food, the above are the sources of supply of lime salts.

Imperfections in dentine.

Through imperfect development a (so-called) granular layer which is found on the surface of dentine in the root may be present on the surface of coronal dentine. The (so-called) globular condition of dentine is another developmental defect. When the enamel covering is lost imperfect dentine softens rapidly under decay without becoming darkened, and is also apt to be exceedingly sensitive.

Lancing of gums.

During the eruption of the temporary teeth, if there is disturbance of the general health traceable to dental irritation, and especially if there be the least sign of cerebral disturbance, there should be no hesitation in freely lancing the gum—tumid or tense—which covers the tooth that is presenting. In the case of a front tooth a straight incision should be made on to the front of its cutting edge; in the case of the molars a crucial incision should be made from corner to corner.

Irregularity of Position.

Irregularity.

Contracted jaws in the young.

Irregularity of arrangement hardly ever occurs among the temporary teeth, but an undue prominence of the upper incisors, which sometimes is acquired, and a tendency to underhanging, from the over-development of the lower jaw as compared with the upper, should receive attention in order that these conditions may not be perpetuated in the second set. The absence of the spacing of the temporary teeth, which should precede their shedding, will point to a likelihood of crowding among the coming permanent teeth and demand watchfulness.

Irregularity of the permanent teeth often results from the want of timely extraction, and even oftener from the untimely extraction of temporary teeth. It therefore behoves the Surgeon who may be called upon to extract teeth for young subjects to acquaint himself with the time of eruption of the different permanent teeth, and with the points of difference between temporary and permanent teeth.

Preventive measures.

Well-developed adult jaws should consequently be thoroughly studied as a type, and compared with the jaws in childhood. It will be then seen that development has occurred longitudinally backwards for the accommodation of the permanent molars, while the part of the jaws that was occupied by the ten temporary teeth, having undergone additional development on its anterior face, is in the adult occupied by the incisors, canines, and bicuspids. In order that these latter may have room for even arrangement it is important that the anterior permanent molars (the six-year-old teeth) should *not* be allowed to take up a too forward position, which they will do if the temporary molars are prematurely lost from neglected decay. On this account, therefore, the timely stopping of the back temporary molars is a practice to be recommended.

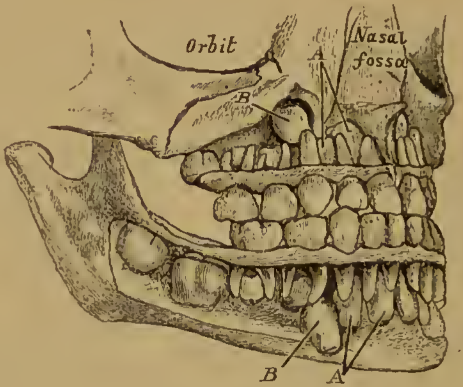
The accompanying figure will show how easily irregularities may be brought about, as the retention of the root of a temporary tooth is enough to prevent the permanent from taking up its proper position.

In judging of the amount of space that there will be for the accommodation of the coming teeth, it is to be remembered that the alveolar portion of the jaws grows up with and is moulded around the teeth it supports, and that there is a strong tendency for teeth to assume their proper position (the action of the tongue and lips conducing thereto), while the replacement of the temporary molars by bicuspids increases the space for the front teeth.

A very common form of irregularity results in otherwise well-developed jaws from the permanent upper incisors being erupted to the rear of their unshed predecessors. In such a case the prompt removal of the temporary tooth is demanded, for if, on the further elongation of the upper permanent incisor, its edge once passes behind the incisor of the lower jaw, at each closure of the mouth the evil is increased, and can then only be corrected by the use of a regulating plate. On the same score, lower incisors may sometimes be kept in the rear of the temporary teeth in order that they may be ready to wedge forward the upper incisors, and thus *secure the overlapping of the upper front teeth* which allows of their true incisive action while it spares them undue wearing away.

Upper front teeth should overlap unders.

FIG. 215.



A. Permanent incisor teeth.
B. Permanent canine.

Drawing of jaws of child æt. 6. A and B point to permanent incisors and canines. The bicuspids are seen embraced by the roots of the temporary molars. The permanent molars, with the exception of the wisdom, are present.

In spite of the above precautionary measures at the time of the second dentition, cases of irregularity will occur from malformation and insufficient development of the jaws. Some of the slighter of these irregularities are amenable to surgical treatment—that is, a timely extraction will allow nature to set all straight—but if a tooth is taken out on one side of the mouth to relieve overcrowding, the preservation of symmetry will often demand the extraction of another on the opposite side. The patient's profile and the relative prominence of the upper and lower dental arches have to be considered in deciding whether permanent teeth should be extracted for regulating purposes, while the soundness of teeth, the direction taken by their roots, the firmness of their implantation, and their comparative durability, are all points to be considered in deciding which tooth should be sacrificed for the benefit of the remainder.

Facts to be considered in extracting for irregularity.

On the extraction of the six-year-old molar.

Sometimes the first permanent molar may with advantage be taken out when the tendency to overcrowding is decided. If this tooth, which is particularly liable to decay, is past hope of permanent preservation by stopping, its extraction in time allows the second molar to come forward and partly occupy its site, and the wisdom tooth to come well into place, while it also enables the front teeth to spread, and thus escape undue lateral pressure and consequent decay.

The one valid objection to the extraction of the first permanent molar, under the above circumstances, occurs when the withdrawal of the prop which this tooth affords at the back of the mouth would cause the lower incisors to bite up unduly on to the necks of the uppers and drive them forward.

The "bite" to be considered.

Here it may be remarked that in all attempts to improve the regularity of the teeth the relative positions of the antagonist teeth in the other jaw must be taken into account.

Regulating appliances.

So far only those cases have been considered that are capable of being benefited by timely extraction, but many cases require for their treatment the use of mechanical appliances. Among these appliances a lever for expanding the arch of the upper teeth (while it presses back the lower) and elastic bands are of great use; while in more advanced cases a regulating plate must be worn, the principle of its action being that it affords a fixed point from which continuous pressure or traction is kept up on the teeth to be moved.

Rabbit-mouth.

The movement of teeth by mechanical means should be gradual, or absorption of bone will result without a compensatory development, and the teeth will be loosened. Twisted teeth can be turned on their axes. Instanding upper front teeth can be trained out, and will be retained in their new positions as soon as they are brought to overlap the lower teeth; prominent and projecting upper teeth can be gradually trained in, but will require to be kept in place for some time by mechanical means to prevent their reverting to their original position. The lower lip passing behind prominent upper incisors increases the deformity which is usually associated with a contracted arch.

In regulating teeth much greater difficulty has to be overcome where contraction or malformation of the jaw causes the irregularity than in those cases where there is simple misdirection of the teeth themselves.

Underhanging.

In some cases complete underhanging of the jaw is present, *i. e.* the upper teeth, back as well as front, are set within the arch of the lower teeth; this condition does not admit of much remedy when once firmly established, but may be prevented to a certain extent by timely extraction of lower teeth together with a training out of the upper. The earlier that irregularities receive attention the better, in order that the misplacement may not be increased, and also because the moving of teeth can only be safely effected in the young.

Insufficient room for canine and wisdom teeth.

Canine and wisdom teeth, owing to the lateness of their eruption and the position they occupy during development, are peculiarly liable to be shut out from the dental arch. The canine being a durable tooth, should in some cases have room made for it by the extraction of one of the teeth that have closed in upon its site. The cutting of wisdom teeth is frequently attended with much trouble, and it may be remembered in the case of young subjects with small maxillæ, whose first or second molars are much decayed, that the timely extraction of either of these teeth may allow the wisdom tooth (if developed) to erupt easily and occupy a useful position. In the upper jaw, if the wisdom is forced to take an outward direction, and so cause irritation of the cheek, it should be extracted. In the lower jaw, when there is insufficient room for it between the second molar and the ascending ramus, its efforts to erupt often produce nerve irritation, chronic spasm of the masseter, the formation of pus between the crown of the tooth and the superjacent gum; it may also cause absorption of the root of the second molar and lay bare its pulp.

Impaction of lower wisdom. Treatment.

In all cases where the impaction of a lower wisdom tooth is a source of irritation, the impaction should be at once got rid of either by the extraction of the wisdom tooth or of the tooth in front. The operation required, as well as the serious results which may attend purulent inflammation about an impacted wisdom tooth, will receive notice later.

Misplacement.

Teeth are sometimes erupted in strange positions; thus, Salter records a case of inversion and eruption of lateral incisors in the nares, and Tomes figures the case of a molar erupted in the median line of the palate, and another case in which the crown of a molar pierced the cheek at the angle of the jaw. In another case, figured by Tomes, the crown of a molar presented at the sigmoid notch, but remained impacted.

Impaction of teeth.

Impaction, or retention, of a tooth within the maxillary bone often occurs without any ill results, but occasionally it is productive of severe mischief. Thus, in a case which occurred in the practice of Mr. Cartwright, sen. (and which is reported at length by Mr. Salter), it was productive of severe neuralgia. In this case the presence of an impacted upper canine, which caused a prominence on the palate, gave rise for eight years to constantly recurring, most severe neuralgic pain, confined to a circumscribed spot on the left side of the vertex of the head. In other cases it may give rise to cystic enlargement or abscess, the latter, perhaps, late in life, from the buried tooth becoming more superficial through absorption of the containing bone. The palate may be involved if a tooth is impacted within the palatine process of the superior maxilla, or an abscess may be formed below the tongue from impacted lower teeth.

Non-development of teeth.

Absence of Teeth.—A few cases are recorded of endentulous jaws. Wisdoms and upper lateral incisors, the teeth most liable to variation in size and shape, are also the most liable to suppression. Occasionally other permanent teeth fail to make their appearance, in which case it may be right to leave their predecessors undisturbed, if they show no signs of loosening; temporary molars may in such cases serve for many years.

Odontomes and dentigerous cysts.

The tendency of particular teeth to take irregular positions, and the liability of others not to be developed, are facts that have to be borne in mind in connection with the probable dental origin of tumours and cysts of the jaws.

The affections they may simulate.

Before passing to the second division of our subject it may be useful to enumerate the morbid conditions which may be simulated by the tumours, cysts, &c., which originate from an unerupted tooth in the ways described in previous pages.

Odontomes may give rise to appearances such as benign or malignant tumours may present, or such as dead bone would produce.

Dentigerous cysts, when slowly forming and before they have thinned the enclosing bone to an extent which would allow of the characteristic sign of *craquement* or pressure, may be difficult to diagnose from solid tumours.

Odontomes and Dentigerous cysts may not present marked differences from fibrous and fibro-plastic tumours or from cystic diseases of the jaw arising spontaneously, or due to the impaction of a foreign body, such as root of tooth, splinter of bone, or bullet. A dentigerous cyst may produce the same symptoms as a cyst formed on the root of an erupted and diseased tooth, and when through inflammation its fluid contents becomes purulent it may, in like manner, resemble an alveolar abscess (*i. e.* an abscess formed around the root of a diseased tooth), and, like it, will be apt to give rise to a fistulous opening.

Empyema of antrum.

Suppuration in the antrum, or Empyema, arises probably in two distinct ways. In the one case it is due to inflammation of the lining membrane of the cavity, which, being continuous with the mucous membrane of the nose, allows of the escape of the contained purulent fluid into the middle meatus by the natural orifice. In the other case the pus is contained in a sac which has expanded into the antral cavity, carrying the lining membrane before it, and then the pus does not find exit by the nasal opening; this latter condition (as pointed out by Otto Weber) is generally present when the root of a tooth originates the mischief by penetrating the cavity and when an alveolar abscess extends into it, while cysts formed on a root and dentigerous cysts expand into the cavity in this manner and may afterwards suppurate.

Diagnosis.

The history of these cases may throw light upon their nature, while a careful examination of the mouth should be made to decide whether the due number of permanent teeth have been erupted, and as to the existence of disease in any tooth in the neighbourhood of the tumour. An exploratory puncture or opening should be made in any case that may have a dental origin before any serious operation is undertaken for the extirpation of the disease.

Treatment.

For treatment it will here suffice to say that the complete removal of any tooth or dental formation involved is demanded, and that for the remaining treatment the ordinary rules of surgery apply.

Diseases of the Teeth.

Dental pathology.

The largeness of the nerve supply to the dental pulp and periodontal membrane, and the liability to irritation and inflammation to which these confined vascular structures are subject, give an importance to diseases of the teeth which they would not otherwise possess; the pain, direct or reflex, which nearly always attends the involvement by disease of these dental vascular structures, and the serious local lesions which may follow their suppurative inflammation, often cause the mere destruction of the tooth as an organ of mastication to be a matter of secondary importance, although in itself sufficiently regretable. Bearing in mind the description of a tooth given at page 535, it will be understood how the maintenance of a tooth in its usefulness depends on the integrity of its component structures, and how it happens that the pulp and alveolo-dental membrane, which in a condition of health are tissues simply subsidiary to the nutrition of the hard structures around them, become—when the tooth is attacked by disease—the parts which have especially to be protected from invasion.

Morbid conditions which cause irritation of dental nerves.

The morbid conditions which may produce irritation of the dental nerves may with advantage be grouped in two divisions.

The first division, including those which cause irritation of the nerves supplied to the pulp with their continuation into the dentine, consists of—

(*a*) Exposure to irritation of sensitive dentine, through loss of enamel resulting from Caries, Erosion, or Fracture.

(*b*) Irritation and chronic or localised inflammation of the pulp when deprived of its protective covering of dentine through the more extended action of the destructive agencies named under (*a*).

(*c*) General inflammation of the pulp, following sooner or later on the previous conditions, and resulting in its sphacelus.

(*d*) Irritation of the pulp through the presence of irregular formations of secondary dentine in the pulp chamber.

The second division, including the morbid conditions that cause irritation of the nerves supplied to the alveolo-dental membrane and to the dental nerves external to the tooth, consists of—

(*a*) Dental Periostitis, *i. e.* inflammation (plastic or suppurative) of the periodontal membrane. This results by far most commonly from inflammation and sphacelus of the dental pulp; it may be idiopathic, may be produced by irritation of the periodontum at the neck of the tooth where it meets the gum, may be set up by exostosis, and occasionally results from the undue pressure of an opposing or contiguous tooth.

(*b*) Exostosis (*i. e.* hypertrophy of the crusta petrosa), sometimes resulting from, sometimes the cause of, irritation and inflammation of the periodontum.

(*c*) A needle-like pointing of the end of the root, and a roughening of its end by absorption.

(*d*) Impaction of permanent teeth in the maxillary bones, and futile attempts to erupt made by such teeth, especially in the case of lower wisdoms.

(*e*) Overcrowding of the teeth.

Odontalgia.

Irritation of the dental nerves may excite pain at the point of irritation, producing toothache, the pain being either confined to the faulty tooth or being centered in it and radiating to the adjoining teeth and to the nerves of the same side of the face and head, but not infrequently it gives rise to reflex pain, in which case the tooth at fault often escapes suspicion on account of its freedom from pain. More remote sympathetic nerve affections are also sometimes caused by dental irritation.

Reflex nerve irritation.

A most unequal amount of pain or nerve disturbance occurs in different subjects from dental lesions of an apparently similar nature. Such differences must be referred to structural peculiarities of the teeth and to the conditions of health and to the diathesis of the patient.

Neuralgia.

A faulty tooth is the real origin of many cases of neuralgia about the head and face, although cold or depressed vital power will determine the time of onset.

That remote sympathetic pain may be due to dental irritation will be easily realised by any one who has felt the distribution of his spinal nerves demonstrated on the scraping of sensitive dentine in his tooth.

Toothache, varieties of, from pulp irritation.

Toothache (or localised dental pain) varies in character according to the part of the tooth involved; these differences will be apparent as the effects of disease in the several dental structures are considered, but it may be here remarked that a darting pain (which may fade away with an ache) betokens irritation and probable exposure of the pulp—that intense pain of a violent throbbing character points to general inflammation of the pulp and may be expected to cease entirely with the destruction of that structure's vitality, and that the pain which attends irritation and inflammation of the periodontal membrane is of a dull aching or gnawing character.

From inflammation of alveolo-dental membrane.

Hyperæsthesia of pulp.

Hyperæsthesia of the pulp may be expected to coexist with the conditions which act on its nerves, and is evidenced by sensitiveness of the tooth to heat and cold. A hot instrument applied in succession to the crowns of suspected teeth may afford valuable evidence on this point, and tapping the teeth may also reveal the over-sensitiveness of any one tooth. Slight periosteal irritation may accompany this condition.

Dental periostitis. Symptom.

Dental periostitis at its onset is often attended by a sensation of fulness in the tooth, which inclines the patient to press it firmly into its socket; this sensation is succeeded by painful tenderness on pressure of the tooth, which is often slightly raised and loosened, while the gum, which at first presents a narrow red line around the neck of the tooth, tends to become diffusely red and tender over the root. When inflammation of the periodontum is circumscribed, or irritation at the root depends on the presence of exostosis, needle-pointing, &c., the pressing of the crown in different directions so as to tilt the end of the root against the socket will be likely to reveal the source of pain; the biting of something hard with one tooth after another may also be adopted as a means of finding out if irritation of this obscure nature is present in a root.

Reflex Nerve Affections due to Dental Irritation.

The nerves of the second and third divisions of the fifth are more liable than any others to reflex affections due to dental irritation. Next to the several branches of the Trigeminus, the nerves of the Cervical and Brachial plexuses are most often involved.

Neuralgia.

Neuralgia.—The following are the most common sites for the manifestation of reflex pain.

(*a*) Another tooth to the one in fault, frequently the one that antagonises it in the opposite jaw, occasionally the corresponding tooth on the opposite side of the mouth, and occasionally also a tooth in front of the one irritated (thus, an innocent bicuspid may ache when the wisdom tooth is at fault).

Hemicrania.

(*b*) The side of the head with the focus of pain near the parietal eminence, due to irritation of a tooth (generally an upper back one) of the same side; this is the source of very many cases of unilateral headache.

(*c*) The eyebrow with the focus of pain at the supra-orbital notch, and the cheek with the focus of pain at the infra-orbital notch, the irritation in these cases being located in the upper teeth.

(*d*) From irritation of the back lower teeth there may result earache, and pain extending over the temple, and also pain passing down the neck.

Pain over the upper cervical vertebra apparently comes on secondarily to the above-mentioned neuralgiæ.

More remote Nervous Affections.

Pain, to quote the words of Mr. Salter, is only one of the phenomena of reflex dental nerve irritation. There may be produced muscular spasm and muscular paralysis, paralysis of some of the nerves of special sense, perverted nutrition. In these pages an enumeration of some of these affections can only be made, and the reader is referred for details of cases to the work on 'Dental Pathology and Surgery' by the above-named author, and to the second edition of 'Tomes's Dental Surgery.'

List of sympathetic nerve affections due to dental irritation.

The following secondary and remote nervous affections may arise from irritation in the teeth, and be curable by the removal of the exciting cause:

Convulsions, &c., resulting from irritation in teething.

Epileptiform seizures. In these cases, when an uneasy sensation is felt in the mouth previous to the attack, the best results may be hoped for from stopping or extraction, as the case may demand.

Delirium from retarded eruption of wisdom teeth.

Firm closure of the mouth through chronic spasm of the masseter muscle is a frequent complication of irritation in or about the lower back teeth.

Wry neck. Pain in the course of the cutaneous branches of the cervical plexus.

Partial paralysis of the arm and hand, with an inability to grasp with the fingers, accompanied by aching pain. (Several such cases have recently been under my observation, a fact which shows their comparative frequency.)

Amaurosis, Strabismus. (Ptosis and deafness are also recorded complications.)

Ulceration in the course of a branch of the fifth nerve.

A case of obstinate leucorrhœa and acute uterine pain cured by the extraction of a tooth was recorded by the late Mr. Sercombe.

One case of fatal tetanus is quoted by Mr. Tomes as having followed the operation of pivoting.

Such are some of the reflex pains and remote complications which may arise from dental irritation in a patient of neuralgic diathesis, but apparently similar exciting causes are constantly present without producing any such results.

In an apparently sound tooth an irregular formation of dentine in the pulp chamber is sometimes the cause of neuralgic pain, and may be suspected if hyperæsthesia of the pulp exists in a tooth exhibiting no other cause for over-sensitiveness.

Exostosis and occasionally needle-pointing of the fang may also be the cause of neuralgic pain at the root of a sound tooth, and may have their probable presence revealed by the tooth exhibiting tenderness on pressure into the socket, and perhaps, later on, by other evidences of periosteal irritation. Being otherwise irremediable, extraction is demanded in these not to be foreseen conditions.

Dental diseases, their progressive character.

With the exception of the above comparatively rare cases it will be noticed by referring to the list of morbid dental conditions given at page 548 that all the affections there enumerated may result from the spread of disease from one dental structure to another, and therefore demand treatment for their prevention and limitation. Thus, when the exterior of a tooth is the first part attacked—as it always is in caries and erosion—the aim should be to preserve the pulp from irritation and exposure, and when the pulp is already exposed through the above diseases or by fracture, the aim should be to prevent its inflammation; while if the vitality of the pulp is past saving, means should be taken to prevent the involvement of the periodontum, and finally, if that tissue is involved, extraction of the tooth may be demanded to relieve pain and to prevent the formation of alveolar abscess with its possible complication of fistulous openings on the face, or the still graver consequences which inflammation external to the tooth may bring about.

Peculiarities in structure of tooth that aid its conservation.

Three facts in the nature of a tooth aid dental surgery in its conservative efforts. The first is, that the dense and evascular character of the enamel and dentine allows a diseased portion of them to be removed and the remainder to be preserved by friction, or by a filling inserted in the place of the removed portion.

The second favouring fact is the continued presence on the surface of the pulp of the odontoblast layer of cells, ready to form secondary dentine over the pulp, and thus shield it, if they are stimulated to renewed action by irritation of the primary dentine.

And thirdly, the small calibre of the root canal in a perfected tooth, and the minuteness of the aperture that remains at the end of the root for the passage of the vessels and nerves, cause the pulp to be so comparatively isolated, that, when diseased, it can with safety be destroyed by escharotics and be extirpated, before its sphacelus has involved the structures external to the root.

Caries, its great prevalence.

The practical remark may here be made, that up to middle age, probably 90 per cent. of the teeth that are lost owe their destruction to caries, while later in life recedence of the gums and absorption of the alveolus—often prematurely induced by the presence of tartar—leads to the loss of many teeth by depriving them of implantation.

Before reviewing the agencies destructive to the teeth, it will be well to consider the nature of secondary dentine and cemental exostosis, which occupy a debatable position between physiological and pathological tooth formations.

Secondary dentine.

Secondary Dentine.—Three different developments come under this name. The *first*, called by Salter "Dentine of repair," has been alluded to already. The loss of dentine externally through abrasion, caries, erosion, or fracture, will oftentimes produce compensatory development internally—at the point where the affected dentinal tubuli abut on the surface of the pulp; this reparative growth prevents pulp exposure when, from attrition, the enamel and a considerable portion of dentine have been worn away from the surface of a tooth, and sometimes it will obliterate the pulp chamber. In cases of decay "dentine of repair" does not often, unaided, prevent exposure of the pulp, but it hinders it, and becomes a valuable auxillary in its protective treatment. (*See* Bicuspid, in A, Fig. 217, p. 556.)

Second form.—Cases have been described by Salter and others in which a nodular outgrowth of dentine or osteo-dentine has projected into the pulp chamber of a sound tooth, and has given rise to severe neuralgia. This development must be regarded as morbid, and has been named by the above author "Dentine excrescence."

"Dentine excrescence."

The *third form* of secondary dentine is essentially an affection of the pulp. "Intrinsic calcification" is the name proposed for it by Mr. Salter, who has described its formation as thus occurring:—Isolated masses of osteo-dentine form, at first usually in the axis of the pulp; these masses enlarge and merge into one another and spread towards the periphery, and may at length occupy the whole of the pulp chamber.

This formation may be regarded as sometimes resulting from and as sometimes the cause of pulp irritation.

Exostosis.

Exostosis is a term applied to enlargement or outgrowth of the crusta petrosa (*see* Molar, in D, Fig. 217), ranging in amount from a slight general thickening (when it can hardly be regarded as pathological) to an outgrowth which may double the size of the root and sometimes has fused together the roots of contiguous teeth. The deposition of cementum may alternate with its absorption, and not infrequently it will be found thickened on the upper part of a root where chronically inflamed periosteum exists, while the end of the root will be bare of it and be bathed in the pus of an alveolar abscess. It often causes a globular enlargement of the end of the root. Sometimes small excrescences of it will form on tooth after tooth, and by giving rise to most severe neuralgia will necessitate their extraction.

Exostosis may arise secondarily to inflammation of the periodontum, and will then be accompanied by extra vascularity and tenderness of adjacent gum, &c. The means for detecting its presence in its early stages, when arising primarily and causing neuralgia, have been already mentioned; symptoms that will be likely to attend its prolonged presence as a source of irritation are those of periosteal inflammation.

The nature of the agencies that destroy the dense structures of the tooth will now be considered, and inasmuch as the sequence of disease, when once the pulp is exposed, is much the same whether the exposure has occurred through caries, erosion, or fracture, the treatment of progressive dental disease and the various affections of the pulp will be considered and illustrated once for all; and, finally, dental disease external to the root, with its complications, will receive notice.

Caries.

The great prevalence of Caries at the present day makes it desirable that its nature and the means for its prevention should be understood. These subjects will therefore be discussed somewhat at length.

Dental Caries or Decay

Always begins on exterior of tooth.

may be described as the disintegration of the hard structures of the tooth by decalcification. It always commences on the exterior of a tooth and saps inwards; when the crown is attacked by it, a fault in the enamel is the first step in its course, and may be due to original faulty development or to mechanical or chemical injury.

Fracture may produce the enamel lesion.

Interstitial decay in one tooth causes decay in the next.

A frequent cause of disintegration of the enamel is the attrition exercised by the sides of crowded teeth on each other, and as this sets up interstitial decay a nidus is thereby formed, which serves as a laboratory for the production of chemical destructive agents which act on the adjoining tooth.

The chemical solvents are formed by acids chiefly derived from the buccal mucus and food mixed with saliva, which—lodging between the teeth and in natural depressions—undergo decomposition. In the formation of acid, carious dentine, when once a cavity is formed, takes a part.

A fungoid growth going by the name of "leptothrix buccalis," which is found in the mouth, is constantly present in carious teeth and probably helps in the disintegrating process.

Overcrowding of the teeth, viscid buccal mucus giving an acid reaction, a vitiated condition of the fluids of the mouth due to derangement of the digestive organs, the eating of sweetmeats (as carried by some young people to a most injurious extent), conduce to decay and should therefore be avoided or prevented. The condition of the mouth attendant on fevers accelerates decay.

Prevention of decay.

The great *preventive* of decay is friction, that is, the keeping of the surfaces of the teeth swept clean of the food, mucus, &c., that tend to lodge between or about them. With this object their lingual as well as labial and buccal surfaces should be brushed night and morning; the direction of the brushing should be always from the gum, *i. e.* downwards for the upper and upwards for the lower teeth, as this removes food from between them by the natural lines of clearance; the masticating surface of the back teeth should also be brushed. Where the mucus is ropy and clings to the teeth, a saponaceous tooth powder should be used.

Among preventive measures must be classed what may be termed preventive stopping. For example, a small spot of decay is often found near the distal edge (of the masticating surface) of the second temporary molar; if this be not stopped the decayed posterior surface of the tooth will come in contact with the mesial surface of the first permanent molar on its eruption, and decay be started in it; then on the shedding of the temporary molar, its successor, the second bicuspid, will have its distal surface exposed to decay from contact with that already existing in the first molar, and thus from lack of a small stopping in a temporary tooth, two permanent teeth are frequently lost or only saved by elaborate fillings.

Insidious character of.

Pain a beneficent warning.

Frequent inspection recommended.

The progress of decay is usually very insidious, a minute and unnoticed fault or fissure of the enamel often leading to extensive decay of the dentine. (See decay depicted on masticating surface of molar in D, Fig. 217.) A warning by pain is by no means always given, but sometimes a twinge or slight ache is experienced when the periphery of the dentine is reached and becomes irritated by saccharine or sapid substances or by thermal changes; if this warning is neglected, often nothing more is felt, till an acute twinge shows that the pulp is exposed, or a caving-in of the enamel reveals a large cavity. It thus happens that the detection of decay in its earlier stages can only be insured by frequent inspection of the teeth. Such inspections should begin with the first teeth and be carried out systematically several times a year if the teeth are to be preserved and much stopping avoided.

For the purpose of examination a mouth mirror and a pointed instrument are required; the double-pointed searcher here figured (Fig. 216) is particularly useful, its curved ends being adapted to pass between the necks of the teeth; it should be employed very lightly in finding out whether a pulp is exposed.

Natural depressions favour the development of caries.

The natural fissures and all depressions of the tooth's surface, together with the sides of such teeth as are in contact, should be carefully examined. A darkening of fissures often points to decay in their depths, and its presence in them may be considered certain if the fine point of the searcher passes through to the dentine. Enamel, on the plane surface of a tooth, when affected by decay, is usually first opaque and of a chalky whiteness, but may become brown or blackened.

Decay at sides of teeth that are in contact.

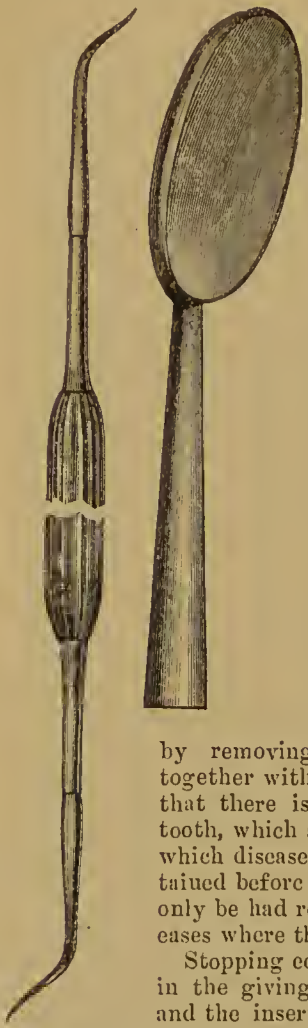
In interstitial decay the defect in the enamel, being out of sight, usually escapes detection, and the first evidence of its presence is given

Discoloration often the first visible sign.

by a darkening of the underlying dentine, which darkening shows through the enamel, and in the case of a front tooth is first observable on the lingual or labial surface, and in the case of the back teeth usually on the masticatory surface (see Fig. 217, A). The amount of discoloration varies, sometimes a distinct black spot being visible and showing through the enamel, in other cases a smoked appearance or a slate colour being imparted to the affected quarter of the tooth, the variable depth of shade being dependent on the distance from the enamel surface at which the decayed dentine lies, and also upon the character of the decay.

In young teeth, with their deficient density, decay runs a rapid course, and the pulp, being larger, is quickly exposed. The teeth of women during the term of pregnancy are apt to decay rapidly, and to be peculiarly sensitive—a reason for having them put in good order in anticipation of that event.

FIG. 216.



Treatment of Decay.

Treatment.

To stay the progress of decay in the hard structures of the crown, two methods are practised, viz. "cutting-out" and "stopping." In either case the affected dental structures must be thoroughly removed and the cavity obliterated.

Cutting-out.

"Cutting-out" decay is accomplished by removing adjacent sound enamel and dentine, together with the diseased portion, in such a manner that there is left an even surface of hard and healthy tooth, which should be well polished. The full depth to which disease has affected the dentine should be ascertained before the adoption of this method, which should only be had recourse to in healthy mouths, and only in cases where the cut surface will be exposed to friction.

Stopping.

Stopping consists in the removal of diseased structure, in the giving to the resulting cavity a retaining shape, and the insertion into it of a stopping which is made flush with and accurately adapted to the edges of sound surrounding tooth structure.

In practice, cutting-away and stopping are often combined. Dentine left exposed should always be well polished, and if sensitive, camphorated spirits of wine may with advantage be applied to it daily, or it may be touched with chloride of zinc, or in the back of the mouth nitrate of silver or a spirit solution of tannin may be applied to it.

Materials used in stopping.

Various materials are used for stoppings.

Gold, skilfully inserted, gives the best results when the tooth is in a condition to bear its introduction.

Amalgams.

Amalgams (among which the so-called gold amalgam is very good) can be introduced into a cavity in a plastic state, and therefore can be packed round corners and adapted to thin walls that might not bear the pressure necessary to consolidate gold.

Silicated gutta percha, from its non-conduction of heat and cold, is valuable as a temporary filling, and is particularly well adapted for cavities which pass below the gum; in positions where it is not exposed to the wear of mastication it sometimes lasts for years.

"Osteo," an oxichloride of zinc stopping, has the advantage of clinging to the walls of the cavity, which consequently requires less shaping; it is also non-compressible, which, with its property of non-conduction, renders it valuable as a temporary filling where the pulp is almost or quite exposed. It will not last long if in contact with the gum, and is not to be trusted in interstitial fillings; but for stopping large cavities on the masticating surfaces of teeth in which the pulp is almost exposed, it is a most valuable substance; and if it wears away on the surface, some of it may with advantage be left in the lower part of the cavity, while the upper part is packed with gold. A saturated solution of mastic in spirit of wine (or some such preparation) mixed with cotton wool, is serviceable as a temporary filling when a carbolic acid dressing has to be retained in the tooth for any time not exceeding a fortnight.

Whatever stopping is used, the cavity should be kept absolutely dry while it is being filled.

The front upper teeth, which are very liable to interstitial decay, can (especially in the young) be temporarily separated by wedging them apart, thus allowing of their being filled from the side or lingual surface without interfering with their contour or leaving the stopping visible; B and C in Fig. 217 show how hidden cavities in other situations can be reached and stopped.

Exposure of pulp to be avoided.

In shaping cavities for filling, the proximity of the pulp with its outstanding cornua has to be borne in mind, and its exposure avoided. (*See* Molar, in D, Fig. 217.)

If a healthy pulp is exposed in preparing a tooth for stopping, a cap of some non-conducting material, which has been moistened with carbolic acid, should be at once placed over it, and then a stopping introduced. (*See* Bicuspid, in D, Fig. 217.)

Ulcerating condition of pulp.

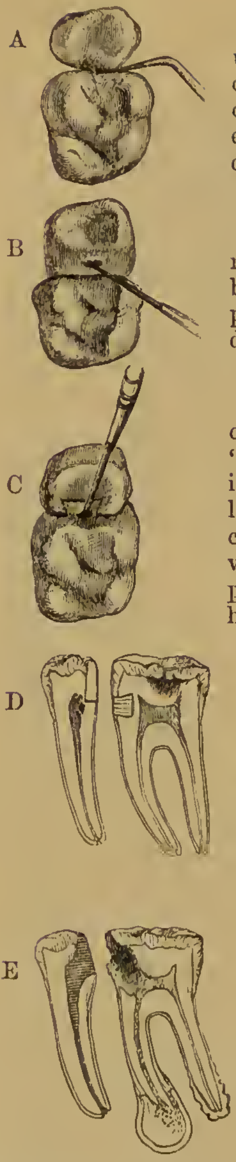
If an exposed pulp has become inflamed at the point of its exposure, and has taken on a secreting action, repeated dressings with carbolic acid to get rid of this ulcerating condition may be had recourse to; and if successful, a stopping may be introduced over the capped pulp; but as a rule, if the pulp has shrunk away from the aperture of exposure, or been the seat of continued pain, it cannot be preserved with comfort, and the best treatment in such a case consists in rapidly bringing about the death of the pulp by the application of arsenious acid, and then, when it is devitalized, by withdrawing it and thoroughly filling the pulp chamber and its root extensions. (*See* Bicuspid, in C, Fig. 217.)

Devitalization and extirpation of pulp.

The accompanying series of drawings, A, B, C, D, E, Fig. 217, illustrate progressive disease in a tooth and its treatment.

Progressive decay illustrated, with its treatment at its several stages.

Fig. 217.



Represents the masticatory surfaces of A, second upper bicuspid and first molar. The darkening of the decay beneath shows through the enamel on the bicuspid. A searcher is introduced to explore the mesial surface of the molar for decay.

The same teeth; the front surface of the molar, having presented superficial decay, has been chiseled down, which gives space for stopping instruments to be brought to bear upon the deeper cavity in the bicuspid.

The same teeth with decay more advanced. The cavity in the front of molar, proving too deep for "cutting-out," is reached by stopping instruments introduced *viâ* the cavity in the bicuspid. The latter tooth having had the enamel on its masticatory surface too much undermined for preservation, will have its contour restored by a stopping introduced into the dovetailed-shape cavity, here seen from above.

Represents continuation of disease as seen in vertical section of lower bicuspid and first molar. In the bicuspid the pulp has been just exposed, but being healthy has had a carbolized cap and a non-conducting stopping placed over it, and has developed a protective shield of secondary dentine. A gold stopping is seen in the molar, of a shape that would ensure its retention if solid. Commencing decay is also shown at the masticating surface of this tooth.

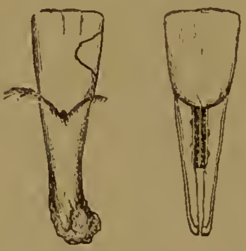
Same teeth. The pulp of the bicuspid is supposed to have been destroyed with arsenious acid and withdrawn from the pulp chamber, which, with its extension to the end of the root, is represented as filled, the lost portion of the crown being also restored. The effects of unchecked disease are seen in the molar, the anterior root being occupied by purulent fluid, and its apex bathed with pus of an alveolar abscess. The posterior root, in which some living pulp still remains, is represented as exostosed, but might with equal truth have been depicted as covered with thickened and inflamed periodontum.

Rhizodontropy.

After the pulp has been extirpated, instead of filling the roots up to their apices (which is not always possible, and in some conditions of the alveolo-dental membrane is not desirable), an alternative plan may sometimes be adopted with advantage. A fine canal is drilled just below the free edge of the gum into the pulp chamber, which is then covered over with a cap and superjacent stopping. (*See* A, Fig. 218.)

Decay at its commencement is, as a rule, capable of satisfactory and quite or comparatively painless treatment. The difficulties of its successful treatment increase with its onward progress, while the nerve complications that have been noticed, and the severe inflammatory lesions which will be enumerated further on, are most frequently the sequelæ of neglected decay.

A. Fig. 218. B.



Pivoting—with vent.

A represents a tooth treated by rhizodontropy. A minute hole is seen passing into the cleared pulp chamber, just beneath the free edge of the gum, which acts as a valve opposed to the ingress of food,&c. The vent (which may be made through a stopping), by preventing the accumulation of fluid or gas in the pulp chamber, stays the development or allows the subsidence of inflammatory mischief about the root.

B represents a new crown affixed to a root by a split gold pin, which is sheathed in a platinum tube fixed with stopping into the rifled barrel of the root. The canal at the end of the root is left open, and the tooth crown is removeable and replaceable at pleasure. In the case of a perfectly healthy root the crown may with advantage be pivoted on it once for all after the end of the canal has been filled with gold.

Pivoting—the ordinary operation.

Fracture.

Fracture of teeth.

Teeth, especially projecting upper incisors, are liable to be fractured. If only a small portion of the crown is chipped off, the fractured edge may be smoothed with a file or stone and touched with spirit to keep it hard and insensitive (filing to amend shape should not be had recourse to while the patient is very young). If the portion broken off is so large that the tooth will be permanently disfigured and yet the pulp has escaped destructive irritation, the tooth may for a time be left as it is, or the remainder of the crown may be removed and a new crown pivoted on to the root; in a young subject the destruction of the pulp preparatory to pivoting should be postponed until it is reduced to its ultimate tenuity by the perfecting of the root.

Treatment according to extent of.

If it is evident that the pulp has become inflamed through the fracture it will be desirable to at once destroy and extirpate it, in order that the periodontum may be preserved in a healthy condition, and, therefore, the root be in a position to carry a pivoted crown with comfort. In young subjects, when the teeth are much crowded and relatively prominent as compared with those in the lower jaw, it may be desirable to extract the fractured tooth and to train in the neighbouring teeth to occupy its site.

Pivoting.—When no other teeth want replacing and the crown of one of either of the six upper front teeth is lost through fracture or decay, the operation of pivoting a new one on to the root is much to be preferred to other modes of attachment.

Roots sometimes to be retained in order that alveolus may not be absorbed.

The roots of the upper front and other teeth are often retained, and may be stopped for the sake of preserving the gums and alveoli intact, for the support of artificial teeth.

Arrested or carbonized decay.—Sometimes in young subjects when

Arrested decay.

the enamel is lost almost simultaneously over the whole masticating surface of a molar tooth decay becomes arrested, the exposed dentine assuming a dark mahogany or black colour, and presenting a density which qualifies it for mastication. Such a result may be aided by the rounding-off of projecting enamel edges.

Erosion.

Erosion.—Occasionally the enamel and subjacent dentine are gradually lost by a process which was called by Hunter "decay by denudation," and by recent writers erosion. The surface of the cavity so formed remains hard and polished and often free from discoloration. It is probable that this gradual wasting away of the tooth substance, without any of the ordinary appearances of caries, is due to the combined action of chemical solution and friction; the enamel in the first instance being affected over a comparatively large area, the dentine, when reached, is exposed to friction which prevents its softening.

This erosion may affect other parts of a tooth, but usually attacks the labial surface at the neck; frequently many teeth in the same mouth are affected by it, a groove being gradually scooped in the tooth just above the gum until the pulp is exposed.

Treatment.

TREATMENT.—An alkaline mouth wash should be prescribed; horizontal brushing interdicted, and if the exposed dentine is sensitive either of the solutions mentioned at page 554 may be applied to it.

In cases admitting of it, stopping should be had recourse to, that the pulp may be preserved from exposure.

Affections of the Pulp.

Affections of dental pulp.

An exposed dentinal pulp is subject to mechanical, thermal, and other irritation. The pain produced by such irritation is of a sharp lancinating character, sometimes passing away with an ache.

Chronic inflammation.—Circumscribed superficial inflammation with increase of sensitiveness may be developed in the pulp at the point of exposure and may continue for a long time in an unsuspected cavity, giving rise to reflex pain or (so-called) neuralgia.

Ulcerative condition.—The exposed surface of the pulp may take on a secretive action, and the tooth be free from pain as long as the exuded sero-purulent fluid finds an exit, and the pulp escapes fresh irritation.

Acute or general inflammation of the pulp is attended by terrible pain of a violent throbbing character, which, after lasting several hours or days, may cease as suddenly as it began, its cessation betokening the death of the pulp. In this case every factor for the production of agonising pain is present, the distensible pulp, largely supplied with nerves, undergoes vascular engorgement within an unyielding case (closed in at all parts except at the aperture of exposure, through which it may bulge and suffer further constriction). The pain is not usually confined to the faulty tooth, but spreads from it to the neighbouring teeth and to the side of the face; during the paroxysms the tooth often becomes tender to pressure, owing to a sympathetic irritation of the periodontal membrane. Prompt measures should be taken to prevent the products of decomposition which result from the sphacelus of the pulp from passing beyond the interior of the tooth and so causing the inflammatory involvement of the periosteum and the formation of alveolar abscess. The pulp occasionally loses its vitality without producing noticeable pain.

Tardy destruction of the pulp.—Instead of losing its vitality at once the pulp may die piecemeal, the chronic irritation that attends this process being often productive of morbid changes in the exterior of the root. A pulp chamber that contains the remains of a decomposed pulp emits a strong and peculiar phosphatic smell.

Calcification of pulp has been described already under the head of *Secondary dentine.*

A sensitive sprouting of the pulp may follow fracture of a tooth. Extraction would be the treatment for this condition, which should be prevented from developing if it is desirable that the root should be retained.

Necrosis of pulp from blow, &c.

Necrosis of the pulp may occur within the unopened pulp chamber of a sound tooth. It is most often consequent on a blow (sometimes a very slight one) rupturing its vessels as they enter the apex of the root. It may supervene on fever. A darkening of the whole tooth results, and is due to the permeation of the dentine by the decomposed colouring matter of the blood.

Salter has pointed out that the pulp thus devitalised may be disposed of by fatty degeneration, but in the absence of treatment (*i.e.* extirpation of the pulp, &c.) it often leads to alveolar abscess.

A tooth knocked out and immediately replaced may become quite firm and obtain vital connection with the alveolo-dental membrane, and will then be in the same condition as the above. Death of the pulp will be evidenced by the absence of sensation in a tooth when touched with an instrument hot enough to evoke sensation in its neighbours.

Affections of the Alveolo-dental Membrane.

Affections of dental periosteum.

Constitutional forms.

Treatment.

Dental periostitis may be local or general, chronic or acute. General inflammation of the periosteal investment of the teeth and their sockets results from rheumatism or attends on a debilitated or unhealthy condition of the system, and demands constitutional treatment. When slight in amount and causing only a loosening of and sense of fulness and uneasiness about the teeth, no local treatment may be required beyond the use of a slightly astringent mouth wash. When the gums are congested they should be scarified and a stronger astringent (tannin dissolved in spirits of wine is efficient) applied to them. Tincture of iodine is a favorite application with some. Any root or tooth that may be an excitant of inflammation is best removed, and tartar should be thoroughly got rid of from beneath the free edges of the gum.

The continuance or oft-repeated recurrence of a congested condition of gum and periodontum leads to the absorption of the alveolar edge and consequent loss of implantation for the teeth; the gradual deposition of tartar upon the root, besides being one of the commonest causes of this condition, is apt to attend and increase it when arising from other causes. When the periosteal inflammation is more acute and pus is formed about the necks of the teeth, a solution of chloride of zinc—8 grs. to the ounce—will be found a beneficial mouth wash and will correct fœtor.

The general symptoms of dental periostitis have been given at page 549; it may be added that when due to rheumatism toothache is apt to be present and swelling and suppuration absent, and that it will often subside of itself, while in a scrofulous subject or when due to syphilis the pain is often slight and the tendency to suppurative inflammation marked, and that in these cases the loss of the teeth is imminent and that their extraction at once may be desirable. Periostitis of the alveolar process of the jaw leading to necrosis may be caused by syphilis, sloughing of the gums, alveolar abscess, or may have a traumatic origin.

Phosphorus disease.

The fumes of phosphorus, productive of "phosphorus necrosis," probably find a readier ingress when the pulp of a tooth is exposed, and other irritants productive of periosteal inflammation may act through the same channel.

Necrosis following the exanthemata.

Necrosis of the alveolar portion of the jaw in children may follow either of the exanthemata, and will not always lead to the loss of the permanent teeth if due time is given for the separation of the necrosed portion.

Inflammation of a sub-acute type may attack the periodontum of one tooth after another and lead to their successive loss in cases where the roots of the teeth are exposed through the recedence of the gums and alveolar margin due to senile absorption or other causes.

Local Dental Periostitis.

Local periodontitis.

With the exception of the condition just named, inflammation attacking the alveolo-dental membrane of a single tooth results from pre-existing disease in the tooth or is due to some local cause of irritation, such as a ligature applied carelessly for regulating purposes or for fracture of the jaw, the accumulation of tartar, or the undue and oblique pressure of an antagonist tooth. Chronic inflammation and thickening of the periodontum is often complicated either as cause or effect with exostosis or with a very small chronic alveolar abscess about the apex of a stump, and is, in these cases, associated sometimes with severe neuralgia, the pain simulating that of tic-douloureux.

Dental cysts.

The Dental Cysts which sometimes form on the roots of teeth are probably generally the outcome of conditions which in their more sthenic form lead to the formation of alveolar abscess. An alveolar abscess may pass into a cystic condition, and it is certain that these cysts (which may contain cholesterine) may suppurate, and then to all intents and purposes they become converted into alveolar abscesses.

Alveolar abscess.

Periodontal inflammation of an acute form, producing Alveolar Abscess, is the natural sequel of death of the pulp. Pus formed between the root and its investing membrane may separate the latter from the former and escape around the neck of the tooth, in which case, if the dentinal pulp is also dead, the tooth becomes absolutely necrosed and is to be regarded as a foreign body. Pus may become diffused beneath the gum, and this is especially likely to occur in the case of lower impacted wisdom teeth. Far more commonly, pus, derived from the pulp chamber or due to the breaking-down of inflammatory lymph, which has been thrown out about the apex of the fang, is contained in a circumscribed abscess which embraces the end of the root (*see* Fig. 217, E) and occupies an excavation in the maxilla. The administration of a saline purgative, together with the local abstraction of blood by the application of a leech to the gum over the root, afford the best chance of cutting short periodontal inflammation that tends to the formation of abscess.

Symptoms.

The formation of an alveolar abscess is usually preceded by great local tenderness to pressure on or over the root of the tooth, and attended by pain of a throbbing character, sometimes by rigors and considerable constitutional disturbance.

A possible cause of pyæmia.

The possible occurrence

of pyæmia from this cause is not to be overlooked. Great serous effusion into the cancellated bone and the soft surrounding tissues not infrequently takes place, mistaken sometimes for erysipelas and occasionally resulting in suppuration; the closure of the eye of the affected side, or a swelling from the lower jaw reaching half down the neck may thus be produced. An abscess connected with an upper molar sometimes causes a fulness over the lower jaw. When an abscess is formed the contained pus tends to find an exit either through a gumboil (so-called), or by a fistulous opening on the face, &c.; an opening on the gum being naturally formed when the mucous membrane is reflected from gum to cheek at a distance from the alveolar border, and a canal through the body of the bone, if the root of the tooth extends below such reflection of the mucous membrane. Gumboil.

An alveolar abscess attached to the upper teeth may perforate the antrum, when attached to an incisor may open into the nares, or when connected with a lateral incisor may pass backwards between the compact layers of the palatine process of the superior maxilla or between the periosteum and the hard palate, and open through or behind the soft palate. It may also form fistulous openings on the face near the inner canthus or under the edge of the malar bone. An alveolar abscess connected with lower incisors may open under or in front of the chin, and above or under the margin of the jaw when connected with the other lower teeth; from a wisdom tooth the pus may pass forwards to the canine, backwards to the fauces, or escape at the angle of the jaw. Pus from an alveolar abscess may pass down the neck, and in one case it found final exit below the clavicle, and in another and fatal case it reached the armpit. Fistulous openings on face, &c.

The pus of an alveolar abscess that distends the mucous membrane of the gum or cheek should of course be evacuated. A chronic gumboil may be regarded as a safety vent, for which the hole made by rhizodontropy may sometimes be substituted with advantage. When alveolar abscess has formed and does not tend to open on the gum, but causes a distension of the bone over it, the tooth, as a rule, should be extracted to prevent further mischief, although in the case of upper front teeth a clearing out of the pulp chamber and the performance of rhizodontropy, coupled or not with a direct opening into the abscess to evacuate the pus, may be the right practice. Preventive treatment.

In alveolar abscess of the lower jaw, a prominence passing out from any diseased tooth and obliterating the natural sulcus between gum and cheek will point to the tooth which should be extracted, and a vertical incision across the abscess track within the mouth may be advisable to prevent the next step in the formation of an external fistulous opening, namely, the distension and thinning of the skin preparatory to its perforation. In these cases warm water should be held in the mouth, and poultices should *not* be applied to the outside of the face.

A fistulous opening on the face, which has given exit to a continual discharge for years will at once close up on the extraction of the tooth or buried root which has caused it, but a permanent depressed cicatrix will be left; in these cases a probe introduced from the outside will very likely impinge on something which feels rough and hard like dead bone, but is really an exostosed and roughened tooth fang; absence of fœtor in the discharge and singleness of the opening point to the presence of a diseased tooth and not bone disease. Diagnosis.

Serious complications of inflammatory action set up by tooth disease.

The disfigurement of a fistulous opening on the face, due to neglected alveolar abscess, is comparatively common, but far more severe complications are sometimes but very rarely produced by the inflammatory involvement of surrounding structures. The seventh nerve has thus been involved, producing facial paralysis. Necrosis of the involved bone has led to a fatal result. Several cases are detailed by Salter in which permanent loss of sight in one eye followed antral abscess or inflammation about the upper teeth. In one case amaurosis of thirteen months' duration was got rid of by the extraction of a carious tooth from the end of which a splinter of wood projected. In the case of a patient, who recently came with symptoms of tumour in the orbit into Guy's, and there died, Dr. Goodhart traced the origin of mischief to caries of the first left lower molar, which gave rise to abscess, suppuration in the inferior dental canal, acute ostitis of left side of lower jaw, extension of disease by pterygo-maxillary fossa to orbit, suppuration in both orbits, ostitis of vault of skull, and pyæmia.

The spasm of the masseter which frequently attends disease about the lower back teeth is sometimes probably due to inflammatory involvement of the nerve, and not simply to reflex irritation. Extraction of the tooth is its cure, and the mouth may be opened sufficiently to allow of this being accomplished by the persevering use of a wedge between the teeth.

Salivary calculus.

Tartar or Salivary Calculus consists of lime salts precipitated from the oral fluids, together with "leptothrix buccalis," epithelial scales, &c.; it especially tends to form on the lingual surface of the lower front teeth, and on the buccal surface of upper molars; a small rim may be often found on the teeth under the free edges of the gum, which may then present a narrow blue line or be generally congested. Brushing in the manner recommended for the prevention of decay checks its deposition. Its presence in large mass may cause ulceration of the tongue, &c., and in much smaller quantity causes the loosening and, if allowed to accumulate, the loss of the teeth. It should be carefully and thoroughly removed with small scaling instruments, used so as not to make the gum bleed.

All teeth that are retained in the mouth should by stopping and scaling be rendered as sound and firm as possible. A patient with tartar-loaded and decaying teeth may travel for fresh air but will hardly find it, and the wholesale and indiscriminate extraction of teeth is to be reprobated, leading as it does to premature absorption of the alveolar process, and thus often reducing in middle age the lower jaw to a level with the root of the tongue and therefore ill fitted to support artificial teeth.

Teeth that project unduly in the mouths of elderly people can sometimes be shortened with advantage and without pain, preparatory to adapting other teeth to them.

Epithelioma set up by jagged points of teeth.

All sharp and jagged edges of teeth should be removed by a file; this is of especial importance in after-life, as localisation of epithelioma of the tongue is commonly traceable to irritation so produced.

Affections of the Gums.

The gums.

Spongy.

The following morbid conditions of the gums have an immediate connection with the teeth. The vascular and spongy gum, which is apt to accompany chronic dyspepsia, has been already noticed.

Hypertrophy of.

A considerable but simple hypertrophy of the gums, chiefly on their labial surface, is sometimes met with when the teeth are overcrowded, the gum being shut out, as it were, from between the necks of the teeth. The preventive treatment for this condition is self-evident, but when it is established, and extraction is inadmissible, it may be reduced by free scarification and the application of tannin, &c.

Polypus of.

To be distinguished from polypus of pulp.

A polypus of the gum is frequently found to project into dental carious cavities which extend below the gum; it is vascular and insensitive, and should be cut away and packed out of the tooth cavity preparatory to the filling of the latter. This gum polypus is sometimes liable to be mistaken for an insensitive polypus of the dental pulp; the latter outgrowth, which was accidentally omitted from the list of pulp diseases, is sometimes found projecting from an opened pulp chamber into a cavity in the crown. It consists of granulations which throw off a somewhat offensive secretion and readily bleed; it usually necessitates the extraction of the tooth on account of the successful resistance it offers to extirpation.

Epulis.

Its connection with periodontum

Epulis occurs where teeth or roots are present, and may have attachments with the periodontal membrane as well as with the endosteal, consequently the extraction of the tooth should usually accompany the excision of the involved alveolar portion of bone.

Ulcerative stomatitis.

The painful "ulcerative stomatitis," so frequently met with in hospital practice among young children, often demands the extraction of loosened and irritating teeth, coupled with the internal administration of its specific remedy, "chlorate of potash."

The Extraction of Teeth.

Extraction, when required.

Speaking generally, extraction may be required for regulation of teeth, which includes the prevention of overcrowding. To prevent or get rid of impaction of a wisdom or other tooth. For neuralgia and nerve irritation when its origin in a tooth is not confined to some condition of the pulp which can otherwise be got rid of. As a rule, in cases where periodontitis (not rheumatic) is established and resists curative treatment. When an alveolar abscess tends towards opening externally. In cases of vertical fracture of the tooth. In the case of loose and diseased teeth or roots which keep up an unhealthy condition of the mouth. When an epulis has probable connection with alveolo-dental membrane. And, finally, in some exceptional cases to allow of more satisfactory artificial restoration.

Instruments for.

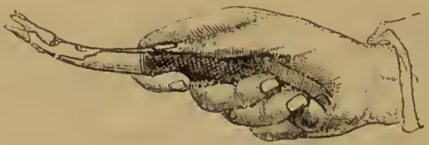
Forceps and Elevators are the instruments now used for the extraction of teeth. The forceps adapted for the removal of the different teeth will be found described in 'Tomes's Dental Surgery,' and only a few special points will be here noticed with regard to them and their use. Forceps should be finely made and well tempered, with blades which should grasp the tooth's neck without pressing on the crown, as extraction is seldom required for sound teeth, but for those that are broken down or hollowed out by decay.

In extracting a tooth the forceps should be applied lightly but closely to its neck and then sent firmly up (or down, as the case may be) until they grasp a part of the tooth that will resist some pressure; the edges of the blades will thus, as a rule, be made to pass just within the edges of the socket, while in the case of the molars the points on the blades will take grip at the bifurcation of the roots; the right hold being obtained by this first movement, the instrument is thenceforth kept at one with the tooth, which is first separated by a particular movement from its socket attachments and then withdrawn.

Manner of holding forceps.

The accompanying drawing, Fig. 219, shows the manner of holding forceps. The little finger may be used as a kind of opening spring, and the thumb should act as a stop between the handles and prevent any crushing pressure.

FIG. 219.



Manner of holding forceps.

Particular movements required to dislodge the several teeth.

The particular movement required for the dislodgment of a tooth depends on the shape of its root. Thus, the upper incisors and canines, together with the lower bicuspids, are more or less conical, and are therefore to be rotated, while the lower incisors and canines, together with the upper biscupids, are more or less flattened from side to side, and therefore are to be moved outwards and inwards. The molar teeth are also to be moved outwards and inwards before being extracted—outwards and downwards in the case of the upper, upwards and often backwards in the case of the lower.

Extraction of wisdom teeth.

In order to follow the curves of their respective roots, upper wisdoms should be extracted downwards, backwards, and outwards, while the crowns of lower wisdom teeth should be carried backwards and upwards.

An elevator should not be used in extracting the upper wisdom tooth on account of the fragile nature of the tuberosity of the maxilla in which it is lodged, but may sometimes be used with advantage for a lower wisdom when the second molar is sound and firmly implanted.

Of impacted lower wisdom

Before attempting to extract a buried and impacted lower wisdom tooth, a careful examination should be made with a probe to see how

FIG. 220.

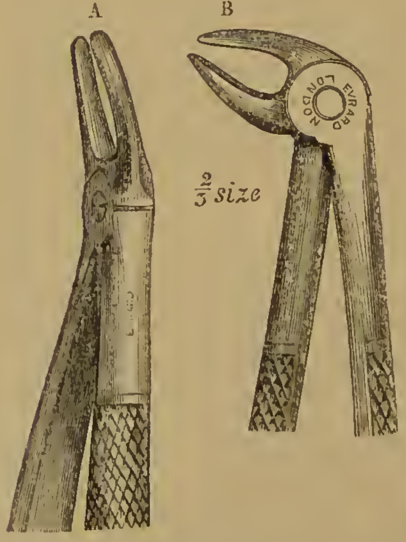


Fig. 220.—A. Upper stump forceps.
B. Lower stump forceps.

FIG. 221.

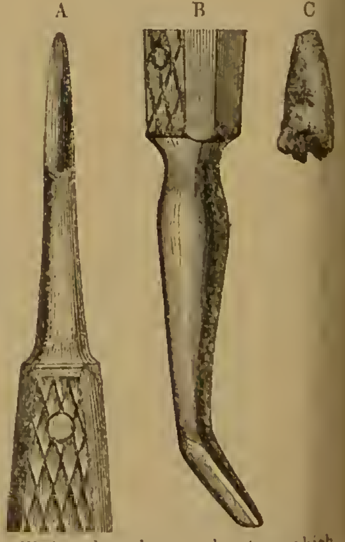


Fig. 221.—Wedge-shaped scoop elevators, which are very useful in extracting buried or much hollowed-out roots, such as C. A. Elevator for upper roots. B. One of a pair of elevators, devised by Mr. C. Rogers, for lower stumps. Such a root as C may sometimes be best removed from the upper jaw with an instrument having a spiral cut on it, used like a corkscrew.

it is situated; sometimes it will be found to hold a horizontal position, its crown impinging upon and causing absorption of the root of the second molar. In cases where it is possible to extract the impacted tooth, lower hawksbill stump forceps with a double curve and an elevator such as shown in Fig. 221 (B), will be found very useful. In cases where the ascending ramus would be necessarily injured in attempts to remove the wisdom, the second molar should be extracted and then the buried tooth may erupt without further trouble, or can be easily removed if still a source of irritation. Stump forceps, as here figured (Fig. 220), are far better adapted for the extraction of bicuspids than the so-called bicuspid forceps.

Of bicuspids.

In the case of a much broken down or hollowed out lower molar, instead of using molar forceps it is better to grasp with stump forceps the one of the two roots which offers the best hold, and if the union between the roots is not strong enough to allow of their withdrawal together, the remaining separate root will be easily removed.

Use of stump forceps for extracting united roots.

The three undivided roots of a crownless upper molar may be extracted with "Coleman's forceps," or with long flat-bladed, loose-jointed stump forceps as made by Collins. When a root is partially covered over with gum the position of its edges should be defined with a probe before an attempt is made to grasp it.

With well-made forceps, lancing the gums before extraction is usually unnecessary, but sometimes when absorption of the bony socket has taken place, the gum is strongly adherent to the tooth and is apt to be torn away with it if not first separated.

Lancing previous to extraction.

Fistulous openings on the face are seldom seen in connection with children's temporary teeth, but the external alveolar plate is often perforated, and the end of a root projects through and causes ulceration, which may lead to adhesion between gum and cheek; the teeth causing this irritation are easily pushed out with an elevator.

Persistent hæmorrhage following the extraction of a tooth and resisting cold may be stayed by tightly packing the socket with rolls of softened matico leaf (Tomes), or with a strip of lint cut to a point and dipped in a spirit solution of tannin, a compress being placed over and kept in place by the opposite teeth. At the same time astringents or iron should be given internally if the hæmorrhagic diathesis exists, or appropriate measures be taken if the bleeding in the case of a woman appears to be vicarious.

Hæmorrhage after extraction. Its treatment.

When natural teeth are lost, artificial ones unquestionably conduce to comfort and health.

Artificial teeth.

In the cases of cleft or perforate palate which are not amenable to surgical treatment, artificial restoration should be had recourse to.

Obturators and soft palates.

AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

Inflammation and Suppuration of the Pharynx.

This affection is met with in the feeble and cachectic subject; it comes on with general and local symptoms, not unlike those of quinsy; indeed both affections are often associated. Pain and difficulty in swallowing are the chief local symptoms, and fever with constitutional disturbance is the general one.

Inflammation of pharynx.

When abscess occurs it may be the result of an acute or chronic

Abscess of pharynx.

inflammation of the part; it shows itself by bulging or projection of the mucous covering of the pharynx. The abscess at times is so large as to interfere with if not prevent deglutition, and occasionally respiration may be even rendered difficult. When these conditions exist the abscess must be opened, the best instrument to employ being a straight bistoury, protected up to the point by a piece of lint or strapping. An instrument called a pharyngotome has been devised for the purpose, and it answers well, but the bistoury is to be preferred. The Surgeon must remember, however, that a post-pharyngeal abscess may be due to disease of the vertebræ, or at the base of the skull, but these cases are generally chronic. Tonics, such as quinine, iron, or the mineral acids, are almost always called for in these cases. Steaming the throat gives great comfort, as well as warm external applications. Nutritious food should always be allowed.

Tumours of pharynx.

Tumours of the pharynx may also give rise to the external appearances of a chronic abscess by pressing the mucous membrane forward, and cancerous tumours are very prone to do this. One of the most marked cases of the kind I have ever seen turned out to be a syphilitic gummatous tumour; it was so large as to make me suspect its cancerous nature, but on investigation it proved to be syphilitic, and was cured by ten-grain doses of the iodide of potassium in bark three times a day.

The cancerous tumours generally commence in the upper part of the pharynx, and cause obstruction of the posterior nares, gradually coming downwards and simulating a pharyngeal polypus. Two such cases have been under my care in young people, and both died. It was a question in both of them whether the disease was not originally in the tonsil, but it appeared to have commenced above the gland.

Dysphagia.

Dysphagia.

Causes.

This is a symptom and may be the result of want of power in the pharyngeal muscles or of œsophageal *ulceration* or obstruction. In the former class of cases the condition may be due to a paralysis of the muscles of the part from cerebral causes, to hysteria, or to diphtheria; for under all these circumstances there may be a more or less complete loss of power in the act of swallowing, food or fluid passing into the nose or into the larynx and producing choking. After the operation of tracheotomy for croup, or some other cause affecting the larynx, the want of adaptive power in the muscles of deglutition is also seen, liquid food at times travelling down the larynx and appearing at the external tracheal wound.

Laryngeal and pharyngeal tumours, and tumours about the base of the tongue, may produce the same symptoms.

Dysphagia is only a symptom.

When dysphagia is due to œsophageal obstruction it may arise from stricture of the tube itself, spasmodic or organic, the latter being caused by cancerous, syphilitic, or simple ulceration. It may be caused by pressure from without, whether from some thoracic, cervical, or aneurismal tumour, or from the presence of a foreign body in the tube. It will be thus seen that dysphagia is only a symptom. It is caused by numberless conditions, and cannot be treated till its cause is known. To make out the cause of the dysphagia is consequently most important, and this should always be done by eliminating one by one every possible cause.

Stricture of the œsophagus.

Stricture of the œsophagus as a rule takes place at its upper end, behind the cricoid cartilage, although it may occur at other parts. It may be *spasmodic* or hysterical, but more frequently it is associated with some kind of *ulcerative* action, simple, syphilitic or cancerous, at times being *cicatricial*, the result of a former injury, such as the swallowing of a corrosive fluid, or other cause. In the great majority of cases, however, the disease is due to cancer. It is a great question whether a simple fibrous stricture of the œsophagus, such as is found in the urethra, ever takes place. *Thoracic aneurism* is capable of producing every symptom of this affection. Varieties.

Spasmodic or hysterical stricture is usually met with in the young, but it may be found at all ages. Paget has described it as a kind of stammering of the muscles. It is probably always associated with some local irritation, some follicular inflammation or ulceration. This may have originated by itself, or been started by an injury, such as a scratch from the passage of a hard or sharp body; it is, moreover, usually associated with dysphagia, or some difficulty as much in using the muscles of deglutition as in passing the food on. The dysphagia is likewise intermittent and uncertain; give the patient food to eat or fluid to drink to test her power, she will tell you it is impossible for her to do what you want, and should she try she will to a certainty half choke. Yet at other times, when otherwise engaged, she will take food. Should a probang be used to examine the part its introduction will be violently opposed by the pharyngeal muscles, yet by a little steady pressure all obstruction will be overcome. Spasmodic stricture.

Œsophageal Obstruction.

When a patient complains of difficulty in swallowing, or rather of difficulty in passing food onwards down the œsophagus after the act of swallowing has been performed, and of its subsequent return into the mouth, the Surgeon should always think of thoracic aneurism as a probable cause, then of cancer of some portion of the tube, and, lastly, of some ulcerative action; he should also always inquire into the history of the case, and satisfy himself that in no previous period has the patient sustained any local injury from the swallowing of boiling water or corrosive fluid. Should the last cause be eliminated, and a careful examination of the chest and other modes of investigation get rid of the question of aneurism, that of cancer becomes the most important, for there is little doubt that in the majority of cases of organic stricture of the œsophagus cancer is the cause. In the early stages of the affection the diagnosis is difficult, indeed at this stage the Surgeon is seldom consulted, for as long as solid food passes the patient is hardly aware of any obstruction existing, the habit of swallowing small portions growing so gradually. An attack of spasm is perhaps the first symptom that attracts notice, this spasm completely closing the canal, and causing *regurgitation* of the food. Œsophageal obstruction. May be due to aneurism, cancer, or ulceration. Means of diagnosis. Difficult in early stage.

At this period of the disease the Surgeon will probably be able to pass a probang, although it may be a small one. As the disease progresses some signs of ulcerative action may appear, such as the discharge of pus or blood, this usually coming up with the regurgitated food; when this occurs there is no better indication of the presence of ulcerative action. Should the patient be middle-aged, the time when cancer may be expected, the probabilities of the disease being of such a nature are very strong, and should there be any local thick- Signs of ulceration. Cancerous variety.

ening behind the larynx, or any glandular enlargement, the probabilities are still greater.

Syphilitic variety.

On the other hand, when the patient is a young adult, and a history of syphilis exists, its syphilitic nature is rendered probable; for simple ulceration or syphilitic ulceration of the œsophagus is sufficient by itself to cause complete œsophageal obstruction, simulating stricture, the mere mechanical obstruction being a strong element, but the spasmodic contraction of the tube is a stronger one in bringing about this result. The fact was very powerfully brought before me in a case I had at Guy's, with Dr. Habershon, some years ago. The patient, æt. 48, was dying from starvation from inability to swallow, on account of œsophageal disease, and for this I performed the operation of gastrostomy. The man lived six days afterwards, and died of pneumonia. After death nearly a complete ring of ulceration was found at the upper part of the œsophagus, and this had caused all his symptoms. Its syphilitic nature could not be decided, although the man gave a history of having had the disease twenty years previously. The repair at the seat of operation was most complete, the stomach and integuments having firmly united. No peritonitis existed.

Example.

I once saw, in consultation with Mr. Pink, of Greenwich, and Dr. Wilks, a case of complete œsophageal obstruction which we all believed to be cancerous, but which so far improved under the expectant treatment as to allow of the passage of well-minced food with comparative comfort; some months later, however, complete dysphagia returned, and the man died, a direct communication having taken place between the œsophagus and the respiratory tract from extension of the cancerous ulceration. Had a bougie been passed in this case a fatal result would probably have taken place as a consequence.

Ulceration extending into air-tube.

Caution in use of probang.

As the disease progresses other symptoms will appear, the ulcer eating its way into the larynx or trachea, when it soon proves fatal. It is from this fact that the Surgeon should always be very chary of passing any bougie down the œsophagus, for when ulceration has taken place he will be very liable to do harm, and may cause perforation of the ulcer into the air-passages, or even the pleura.

Treatment by dilatation.

Useful in the cicatricial stricture.

TREATMENT.—Assuming the pathology of stricture of the œsophagus to be correct, the treatment by dilatation, *except in the cicatricial form*, is not only useless, but dangerous; when it is due to ulceration, cancerous or otherwise, the irritation of a bougie must do harm, and cannot do good; and where it is caused by the presence of a cancerous or an epithelial tumour, the passage of an instrument is likely to hasten its breaking up and prove injurious. In the cicatricial form, or that which has followed upon some local injury, such as that produced by an irritant fluid, there is good reason to believe that dilatation is of great value, and if such treatment does not cure the disease, which it can hardly do, it will at least prolong life. A bougie as large as can be passed should be introduced daily, and retained as long as possible.

Diet.

The patient must take, as long as he can, nutritious food; solids finely minced, and, when this is impossible, fluid. Milk can often be taken when other food is refused. Beef tea is always good, and Hassall's flour of meat mixed with it is a good addition. Brand's liquid essence of meat is invaluable.

When swallowing becomes impossible, the cautious introduction of a fine tube down the passage may be entertained, liquid food being thus introduced. But this proceeding is a hazardous one, and can rarely be repeated for many days. Nutritious enemata appear to me to be preferable, beef tea thickened with flour or arrowroot, and milk and egg administered alternately every four hours, tending more than anything else to keep up the powers of the patient. When all these means fail, or rather before—for it is known that life cannot be very long maintained under such circumstances—the question of opening the stomach by an operation must be entertained.

Enemata.

Gastrostomy.

Billroth recently has cut down upon the œsophagus and excised the cancerous growth, but without success; it is an operation that is only commended to our consideration by the eminence of the Surgeon who performed it.

Foreign Bodies.

Foreign bodies in pharynx.

These are occasionally arrested in the pharynx; when pointed, they may become fixed in the soft parts about the base of the tongue, or between the pillars of the fauces; when bulky and solid, they are generally arrested at the narrowest portion of the tube, its lowest portion, behind the cricoid cartilage. The discomfort caused by this accident is at times very great; difficulty in swallowing, pain, and the disposition to vomit being common symptoms. A pricking sensation in the part is generally present, although it must be remembered that this symptom often remains after the substance has been dislodged. Where the epiglottis or upper orifice of the larynx is irritated, cough and other laryngeal symptoms will be produced. The same may also be said when a solid body becomes impacted behind the larynx, the larynx being either mechanically so compressed as to cause suffocation, or so irritated as to give rise to spasm, either cause being sufficient to produce death.

Symptoms.

When small bodies lodge in the part, they will set up inflammation and suppuration; abscesses in the pharynx and neck are not uncommon consequences; indeed, instances are on record in which disease of the cervical vertebræ has been the result. Coins may be impacted in the pharynx for many months, and Dr. O. Ward relates a case ('Path. Trans.,' 1848-9) in which a halfpenny was so placed for eight months, the child at last, in a fit of coughing, bringing it up.

May cause abscess.

May be impacted.

Treatment.—Whenever a foreign body, large or small, is suspected to have become lodged in the pharynx, a careful surgical exploration should be made with a view to its removal. The mouth and fauces are easily reached by the index-finger, and on carefully passing this around the mouth, base of tongue, and fauces, any foreign body will be detected; no force need be employed, the finger should only sweep the surface of the parts; by doing this the foreign body may be dislodged, the finger-nail materially assisting. When any body is fixed in a part, it may be removed by forceps, the ordinary dressing forceps, as a rule, sufficing; when the body is lower down the revolving œsophageal forceps, as made for me by Mr. Krohne, of Duke Street, Manchester Square (Fig. 222), may be used.

Treatment.

Exploration.

Use of forceps.

When a solid mass has become impacted behind the cricoid cartilage in the lower part of the pharynx, and the finger cannot dislodge it, laryngotomy may be called for to preserve life. Force should never be employed to push it down the œsophagus into the stomach. Should a second attempt to move the impacted body fail, it is well to desist for

Laryngotomy.

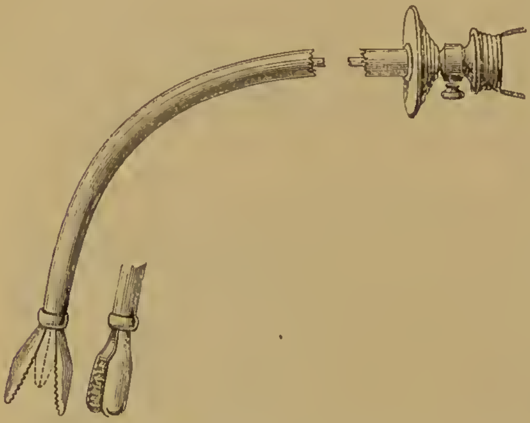
Force never to be used in pushing body down.

a time, a renewal at a subsequent date often succeeding, owing to the disappearance of the spasm which existed when the first attempt failed. Soft bodies likewise become softer, and can be consequently the better removed or pushed downwards; a good deal may, however, be done by digital manipulation, both inside and outside the mouth, to dislodge any foreign body. False teeth not infrequently become dislodged and impacted in the pharynx. Paget has related such a case, where a man in a fit got one of his sets into the pharynx, where they remained four months. Sir J. Paget then dislodged them from between the base of the tongue and the epiglottis ('Med. Times,' 1862). Some years ago, when performing ovariotomy upon a lady, under chloroform, alarming symptoms of suffocation set in, and on opening the mouth I found half a set of teeth had become dislodged, and had fallen into the pharynx. I have also heard of several similar cases. Before giving chloroform to old people the teeth always should be examined, and false sets removed. When such bodies become impacted, much care is needed in their extraction, and the utmost gentleness should be used. The laryngoscopic mirror is often of great service in detecting the presence of a small impacted body, and in guiding the Surgeon to its position.

Examples of impacted false teeth.

Care in extraction.

FIG. 222.



Revolving pharyngeal forceps for the removal of foreign bodies, &c.

Wounds of pharynx.

Wounds of the pharynx are occasionally met with from accident, falling with a sharp body in the mouth being the most frequent; when they do not involve any large vessel, they generally do well. Durham relates a case in 'Holmes's System of Surgery,' vol. ii, where Mr. Johnson, of St. George's, had to ligature the carotid artery for repeated bleedings following a punctured wound of this part caused by the end of a parasol. It was in a boy æt. 7; a good recovery ensued.

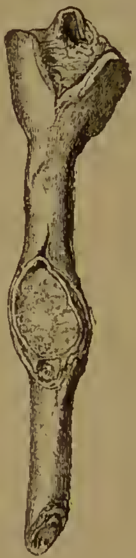
Foreign bodies in œsophagus.

Symptoms.

May perforate heart, aorta, &c. &c.

Foreign bodies in the œsophagus are mostly arrested at the two narrowest portions of the tube, its origin behind the cricoid cartilage, or at its lower end, just above the diaphragm, and anything that can be swallowed may be so impacted. The symptoms the accident causes are extremely uncertain: when the upper part of the tube is obstructed the laryngeal symptoms are generally alarming (Fig. 223); when the lower end is affected, and the obstruction is not complete, they may be very slight. As a rule, however, besides the mechanical symptoms the mere presence of a foreign body in the tube may cause secondary inflammatory symptoms, which may give rise to a fatal result. Thus, a case is on record in which a fish bone perforated the heart, and caused a fatal hæmorrhage (Andrews, 'Lancet,' 1860); another, where a sharp spiculum of bone caused ulceration, on the third day, into the aorta (Spry, 'Path. Trans.,' vol. iv, 1853); a case where disease of the spinal cord ensued as a consequence of ulceration of the intervertebral substance, following the arrest of a piece of bone in the œsophagus (Ogle, J. W., 'Path. Trans.,' vol. iv, 1853); and another in which a piece of gutta percha formed for itself a bed in the wall of the œsophagus for upwards of six months, and destroyed life by causing ulceration into a vessel and hæmorrhage (Erichsen). In another case a man died suddenly from hæmatemesis, the cause being discovered after death to be a half-crown impacted in the œsophagus, and ulcerating into the aorta. One case is recorded where a fish bone passed through the posterior wall of the œsophagus, and was found embedded in pus in front of the vertebral column (Gairdner, 'Med.-Chir. Soc.,' Edinburgh, 1859). My friend Dr. Sutton has also told me of a case where a lunatic so plugged his pharynx with tow as to cause his death by suffocation.

FIG. 223.



Preparation showing a piece of pudding impacted in œsophagus of a child, æt. 2 years, which caused death by laryngeal spasm. Guy's Hosp. Mus., 1793^{40}.

Diagnosis.

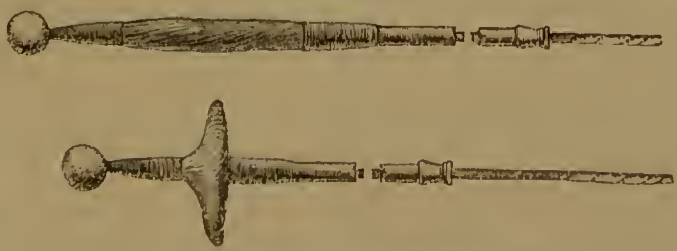
Diagnosis.—It is quite impossible for a Surgeon to speak with certainty as to the presence or absence of any foreign body in the œsophagus under all circumstances. When it can be felt by the finger or bougie, no doubt can be said to exist; but, on the other hand, it may often be present when no such evidence can be obtained. A foreign body of small size may become so fixed in one side of the tube as to escape detection in the passage of an instrument.

Treatment.

If soft or digestible may be pushed down.

TREATMENT.—When a foreign body is detected the sooner it is taken away the better. Should the material be *soft* and *digestible*, it may be pushed downwards by means of the ordinary sponge or ivory probang, or tube of a stomach pump, care being taken not to use much force, for such material will soften after the lapse of a few hours by the natural secretion of the part, and will thus be more readily pressed on. Should the offending body be pointed, hard, or large, all idea of pushing it on must be dismissed, for such practice is dangerous; it has, however, been done with impunity, a jagged plate with teeth having been

FIG. 224.



Horsehair probang expanded and unexpanded.

Horsehair probang.

Forceps.

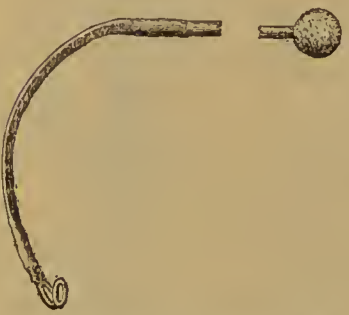
pushed into the stomach and passed per anum. *Small pointed bodies* may be caught by the "horsehair" probang (Fig. 224), passed carefully beyond the position in which the foreign body is supposed to be placed, and then gently expanded, rotated, and withdrawn, the compression and rotation of the instrument causing the hair to spread out and expand the œsophagus. *Sharp-pointed bodies* or *impacted hard irregular bodies* should be removed by forceps when possible. Those figured in No. 222 are the best, for they can be made to open in all directions when in the pharynx.

Emetics.

Vomiting will often cause the dislodgment of a foreign body, but at times it may render it more fixed.

When vomiting cannot be produced by the administration of medicine, a solution of tartarized antimony, or of apomorphia gr. $\frac{1}{10}$, injected beneath the skin is said to do as well.

FIG. 225.



Money probang, with sponge at one end.

Coins and other flat but not pointed bodies may often be removed by means of the money probang (Fig. 225), the circular hook catching the coin and drawing it upwards.

Swallowing a large bolus of bread may carry downwards any fine bone or bristle, a draught of liquid assisting the process.

Œsophagotomy for removal of foreign bodies.

For stricture and cancer of œsophagus.

Œsophagotomy has an established position in practical surgery, and the principles laid down by Arnott, many years ago, are now generally accepted, viz.: "where a solid substance, though only of moderate size and irregular shape, has become fixed at the commencement of the œsophagus, or low down in the pharynx, and has resisted a fair trial for its extraction or displacement, its removal should *at once* be effected by incision, although no urgent symptoms may be present." ('Med.-Chir. Trans.,' vol. xviii.) Mr. Cock, writing in 1867 ('Guy's Rep.'), says: "The longer a foreign body is allowed to remain, unless we wait—a forlorn hope—for suppuration to loosen it, the more firmly it will become impacted. It would appear that success attends a speedy operation; whereas, where the use of the knife has been delayed until local inflammation, suppuration, or even sloughing has been established, the result of the operation has been fatal." Mr. Durham tells us that out of twenty-one cases of the operation for the removal of foreign bodies seventeen were successful, and in the four fatal cases death was in no way to be attributed to the operation. ('Holmes's Surgery,' 1870, vol. ii.) In recent times the œsophagus has been opened for stricture and cancer of the passage. Dr. Menzel reports ('Wiener Med. Wochenschrift,' No. 56, 1870) two cases in which Billroth performed œsophagotomy. The one which was successful occurred in a boy, æt. 11, who seven years before had swallowed some potash lye. Two days before the operation neither liquid nor solid food could be swallowed, and no bougies could be passed. The œsophagus was opened and a cherry stone, which had been fixed in the stricture, was removed. The boy drank water directly afterwards, and in twenty-six days the wound had healed. The report does not say that he could swallow freely. The second case was for cancerous disease, but the man died.

Operation of œsophagotomy.

Mode of performance.

The operation.—The patient should be placed in the recumbent position with his shoulders slightly elevated, the head being turned to the right or left side, according to the point of projection of the foreign body. Where this guide is lost the left side should be selected, the œsophagus inclining rather to that side. An incision should be made along the anterior border of the sterno-mastoid muscle, about four or five inches long, its centre corresponding to the position of the foreign body, and all the soft parts carefully divided. The omo-hyoid will then come into view, and beneath this the carotid sheath with its vessels will be seen. Should more room be required the sterno-hyoid and sterno-thyroid muscles may be partially divided. The vessels, with the sterno-mastoid muscle, should then be drawn well outwards by means of the hooked retractors. The larynx with the œsophagus behind can then be examined, and the position of the foreign body accurately made out, pressure with the finger on the opposite side tending materially to make this point clear. Should the foreign body project, the larynx may be drawn well forwards or towards the opposite side, and a cut made down upon the projecting part, the wound being carefully enlarged to allow of any extraction without force. Where a guide is wanted to the œsophagus, the introduction of a long pair of forceps through the mouth downwards into the pharynx is a good help, the point of the forceps pressing forwards the œsophageal wall. All vessels that bleed during the operation should be at once twisted or ligatured, and on opening the œsophagus the recurrent laryngeal nerve should be carefully avoided. The wound should be left open. The patient must be fed for a few days by means of a small œsophageal tube, introduced through the mouth into the œsophagus below the wound, care being taken during its introduction to keep the point against the opposite wall. Convalescence, as a rule, goes on steadily. I have been fortunate enough to see the operation twice successfully performed by my colleague, Mr. Cock, and the facility with which it was done has given me a very favourable opinion of its value. ('Guy's Rep.,' 1858, 1867.)

A successful case of this kind was brought before the Surgical Society of Ireland by Mr. Wheeler, on March 16th, 1875.

CHAPTER XIV.

INJURIES OF THE ABDOMEN.

Contusions and Rupture of the Viscera.

Injuries of the abdomen, like those of the cranium, derive their principal importance from the nature of the contents of the cavity. The integuments and muscles forming its parietes may be severely injured, and results follow which are simply of local importance; but if the peritoneal lining of the cavity is involved, or any of the viscera are injured, the case assumes a grave aspect. The presence of a wound is always an extra element of danger, the amount greatly depending upon the extent and character of the visceral complication.

Contusion.

Under certain conditions a trifling blow on the abdomen may give

General remarks on the abdomen.

rise to symptoms of an alarming nature, when a severe one is recovered from without exciting more than a fear. "The absence of shock immediately succeeding a severe lesion may lull suspicion, as its presence may by simple contusion excite alarm." Every abdominal injury, however trivial it may seem, must consequently be regarded with apprehension, and the utmost care observed in its treatment. This can be readily accounted for, says Poland ('Guy's Rep.,' 1858) "when we consider the numerous and vital structures contained in the abdomen: a serous membrane highly prone to inflammation; the 'peritoneum,' occupying an extensive amount of surface; a lengthy coil of organized tubing, 'the stomach and intestines;' solid substances, made up chiefly of blood-vessels, &c.; the liver, spleen, and kidneys readily lacerable and liable to rupture, causing nearly always fatal hæmorrhage; receptacles for fluid, 'the gall and urine bladders,' which, under distension and undue force, may burst; large vessels coursing along the posterior wall, 'the aorta, vena cava,' &c.; and lastly, above all, the sympathetic nerves, consisting of the solar plexus and its numerous satellite plexuses and branches of such high organic importance, that injury or shock thereto may be attended with irreparable results. All these structures are, moreover, enclosed within soft elastic parietes, capable of great distension, which although readily able to resist shock and external violence without injury to themselves, yet may allow the force to be transmitted and expended on the contents with dire effect, and yet without leaving a trace or mark in the exterior."

Diagnosis of the effects of contusion difficult.

In forming a diagnosis in this class of cases the method of exclusion is the only sound one, every possible complication being entertained and dismissed only when the weight of evidence is against it, and the ultimate conclusion being founded as much on negative as on positive evidence.

Only developed in the progress of the case.

"I am unacquainted," writes Le Gros Clark ('Surgical Diagnosis,' 1869), "with any diagnostic sign by which we may predicate whether shock following an abdominal injury exists primarily, apart from, or as expressive of actual breach of texture. Time alone can develop the true nature of the case, either by renewal of vigour or by the development of fresh symptoms."

Symptoms as a guide.

A person receives an injury to the abdomen from a blow, fall, or the passage of a wheel over the part. This may cause a contusion of the abdominal wall more or less severe, with no visceral complication whatever; or it may produce a laceration or rupture of a viscus or vessel that will end in death, without any (or very slight) external sign of injury.

Pain.

Pain as an immediate effect of the injury, is no indication of internal mischief, for in simple abdominal contusions it is at times very severe; but when it *lasts* or becomes *fixed* in one spot, it is a symptom of importance; and when it *radiates* from one spot it is most characteristic.

Persistent vomiting.

Persistent vomiting is a suspicious symptom of visceral mischief.

Collapse.

Relapsing collapse.

Collapse, as a direct consequence of a blow, when of a passing nature, is of small value as a diagnostic sign; but if *persistent* or *relapsing* indicates great mischief; for collapse, more or less complete, is a common effect of all abdominal injuries, but a collapse coming on at a distinct interval of time following the injury, as a rule, means internal hæmorrhage.

Sudden death from shock.

How far sudden death is attributable to a shock or collapse from a blow on the epigastrium or stomach without organic lesion is an open question, sound evidence being wanting to prove the point. Dr. A. Taylor, in his work on Medical Jurisprudence, gives one case, that of Mr. Wood, in which a man, when fighting and intoxicated, suddenly died after the receipt of a left-handed blow on the pit of the stomach; but the evidence in the case and the facts revealed at the post-mortem are by no means conclusive as to the cause of death. The opinion has probably been accepted, on the authority of Sir A. Cooper, who was in the habit of relating how two men were working, one of whom was wheeling along a heavy load, when his comrade thus addressed him: "That is too much for you; stand aside, and let me, a better man, take it." He accompanied this with a slight blow on the scrobiculus cordis, and the man immediately let the barrow fall. The man died on the spot, and after death no lesion was discovered. This case, however, had only been related to Sir A. Cooper. No better case can be brought forward to support the theory. Under these circumstances, I think, Mr. Pollock must be right when he asserts that he is somewhat sceptical on the point, that death can occur without any organic mischief resulting from the blow at the time; that sudden death, attributable to a blow on the stomach or epigastrium, must be a rare occurrence; and that medical men should be extremely guarded in ever offering an opinion as to the cause of death in such supposed injuries, without satisfying themselves, by most careful and minute post-mortem investigations, that no violence has been done to the viscera, either abdominal or thoracic. ('Holmes's Surgery,' vol. ii.) This question may, therefore, be put aside.

Sir A. Cooper's case.

Pollock's remarks.

What then, it may be asked, are the usual consequences of an abdominal injury or contusion? What are the risks and complications? The following facts will illustrate these points.

Effects of contusion in 71 cases. Passing collapse in 44.

At Guy's Hospital, during eight years, seventy-one cases of abdominal injuries were admitted. In *forty-four* of these, beyond a passing collapse, no serious or definite symptoms were produced; tenderness over the injured part from the contusion was the most marked, but no evidence of any internal mischief was ever manifested. Rest in bed for a few days was the chief treatment, associated with the local application of a warm fomentation. In all, convalescence was rapidly established. In *ten cases* symptoms of *peritonitis* showed themselves, such as excessive tenderness over the injured part, increased by movement; thoracic respiration resulting from the indisposition of the abdominal muscles to act, and thus by pressure on the inflamed peritoneum to cause pain; nausea, and in some cases vomiting, fever, and constitutional disturbance, varying according to the severity of the inflammation. In seven of these ten cases *absolute rest* in the horizontal posture, warmth applied locally, either by means of fomentation or cataplasms, in some instances leeching, and *in all*, *opium* given in moderately full and repeated doses was the treatment adopted; and in every case the inflammation was subdued before it had attained a dangerous degree of severity. In *three cases*, however, an acute peritonitis set in, and in one of these a fatal termination was the result. In *seventeen* cases rupture of the viscera took place. As a type of an ordinary case of peritonitis after injury the following case is given:—

Peritonitis in 10.

Ruptured viscus in 17.

A man, æt. 22, in a fight received a blow from a woman on his right

Typical example of peritonitis after blow.

side; the accident was followed by syncope, from which he soon recovered; he felt no pain or inconvenience from the injury for one week, having, as usual, followed his occupation. At this date severe abdominal pain was experienced at the seat of injury; the pain rapidly increased and spread over the whole abdomen; vomiting also appeared, accompanied with considerable constitutional disturbance; and in this condition he was admitted into Guy's. He was put to bed, and twenty leeches were at once applied; a grain of opium was given, and repeated three or four times daily, and perfect rest enjoined; in a few days these symptoms subsided, he was enabled to take food without vomiting, and pain ceased, convalescence being gradually established.

Remarks on the case and treatment adopted.

REMARKS.—The case is interesting from the fact that some days elapsed between the receipt of the injury and the appearance of the peritoneal symptoms, as well as from the important practical point to be learnt from the rapid success that followed upon the treatment which was pursued. Rest, to its fullest extent, was doubtless the chief element of success—rest by position in the horizontal posture, and rest maintained by the administration of opium. It is not unfair to believe that, if this treatment had been primarily adopted, the symptoms exhibited would never have made their appearance; but by the man following his occupation, the repair which was required after the injury could not be efficiently carried out, and, as a consequence, inflammation ensued. Of all cases which require absolute rest, abdominal injuries demand it most, and in no example, however apparently trivial, should it be neglected. If the mischief be but little, that little will more rapidly be repaired; if great, its evils and its consequences will be materially modified. The case above quoted indicates both points, viz. its primary necessity and its secondary good results.

It is thus seen that a blow upon the abdomen may be followed by a simple contusion of the abdominal wall, and in exceptional cases by peritonitis; this may terminate fatally, but in the majority of cases where such a result ensues it is from rupture or lesion of some internal part.

Signs of ruptured viscus obscure.

What then are the symptoms of an internal abdominal lesion? How is it to be made out that such exists? What guides are there to the viscus that is wounded?

To answer these questions satisfactorily much space is needed, more, indeed, then can be given to it in this work; yet helps to diagnosis may be given.

Proximate guides.

The nature and position of the injury afford a kind of clue. Where the loins are the part involved, the kidneys are prone to suffer; where the right hypochondriac region is the seat of injury, and the ribs on that side are fractured, the liver is probably the organ injured. On the left side the stomach is the organ likely to be hurt, or more probably the spleen; in the umbilical region the intestines; in the pelvic region the bladder.

Ruptured liver.

Rupture of the liver usually destroys life by hæmorrhage; in the majority of cases within a few hours of the injury, in some within a few days; thus out of nine consecutive cases of ruptured liver five died rapidly, three survived three, seven, and nine days respectively.

Extensive.

When the laceration is *extensive* death is always speedily produced by the shock and hæmorrhage; coldness and general pallor of the whole body, with a feeble pulse, sighing respiration, and restlessness preceding death. When the laceration is *less severe* life may be prolonged; thus I have recorded in another work the case of a man æt. 45, who, when drunk, fell out of a cart, and the wheel was said to have passed over his head. He was admitted, intoxicated to an extreme degree, under Mr. Birkett's care into Guy's Hospital, and he presented no evident symptoms of internal injury beyond slight hæmorrhage beneath the right conjunctiva, indicative of cranial mischief. He was put to bed, and soon fell asleep, and on the following morning, with the exception of the hæmorrhage into the orbit, *no signs* of mischief could be detected. Rest, however, in the horizontal position was strictly enjoined; but to this the man would not submit, and thirty-six hours after the accident he would get up and walk about; having done so, he felt a sudden pain in his side, fell back, and died. After death a fissured fracture passing across the right orbit was found, without brain complication; the peritoneal cavity contained about a pint of blood, which had evidently come from a severe laceration of the liver; a mass the size of a man's fist situated in the right lobe having been nearly separated. The right kidney was also fissured on its surface, and covered with coagulated blood. In this case the man clearly died from secondary hæmorrhage from the ruptured liver.

Slight.

In rare instances the liver may be crushed partially, and its peritoneal covering be left uninjured; in such cases life may be prolonged, and, when the mischief is not extensive, may be saved.

Fissures of the liver are usually met with on its upper surface. A diseased organ is more liable to rupture than a healthy one.

Recovery may ensue after ruptured liver.

There is little doubt that recovery may take place when the fissure is limited and the case uncomplicated; when these cases occur they are classed with those of traumatic peritonitis; and when proving successful their true nature is not revealed. Preps. 1948—1951[5] in Guy's Hosp. Museum, with drawings, illustrate this truth.

Ruptured spleen.

The spleen is frequently injured, and such cases are by no means always fatal. This organ is sometimes lacerated by a fractured rib, or torn by a dragging of its surface. When fatal the result occurs from hæmorrhage. Prep. 2018, Guy's Museum, illustrates its repair after injury.

Subdiaphragmatic abscess.

Subdiaphragmatic abscess may occur as a consequence of abdominal injury. The Surgeon should suspect its presence in all cases in which recovery is slow and attended with abdominal pain.

Ruptured stomach.

Symptoms and result.

Rupture of the stomach generally proves fatal from shock alone, or irrecoverable collapse; the amount of distension of the organ, its contents, and the extent of laceration, influencing the result. When the rupture is large, and effusion of its contents into the abdominal cavity takes place, acute peritonitis, with or without hæmorrhage, will kill, if shock does not. When the rupture is small, and the stomach empty, there is a chance of recovery, local peritonitis subsequently gluing the injured part to the surrounding tissues.

When life is prolonged beyond immediate death, the patient will complain of an acute and constant pain radiating from the seat of injury, so peculiar indeed that "the intensity of it absorbs the whole mind of the patient. who, within an hour from the enjoyment of perfect health, expresses his serious and decided conviction that if the pain be not speedily alleviated he must die." Vomiting is a constant symptom, first of the contents of the stomach, and often of blood; collapse, rigors, and syncope are often met with.

Incomplete rupture of coats.

Incomplete rupture of the coats of the stomach is found sometimes after death. In Guy's Museum (Prep. 1817[25]), there is a stomach of a child æt. 7, in which from a sudden blow while the stomach was full the mucous membrane is detached and lacerated in a remarkable manner.

Ruptured intestine.

Rupture of the intestines, both of the large and the small, is a somewhat common form of abdominal injury; a fall, a blow, the passage of a wheel over the abdomen, or even violent muscular exertion may produce it.

Examples.

Hennen ('Military Surgery') gives a case where a soldier received a contusion of the abdomen; sloughing of the integument followed, and artificial anus, but in six months a recovery took place, the fæces having resumed their natural course. In Guy's Museum there is a specimen (Prep. 1851[85]) of perforation of the small intestines of a man who had received a kick from a horse; he died thirteen days after the accident with extensive peritonitis, following fæcal effusion. Prep. 1851[86] consists of a portion of jejunum, taken from a man who had been kicked in the abdomen; the injury was quickly followed by symptoms of extravasation, and death in forty-eight hours; Prep. 1850[88] was taken from a case of perforation of small intestine from the kick of a horse, terminating in death in twenty-four hours; No. 1851[89] is a portion of jejunum presenting two openings in which the mucous membrane is inverted following the blow from a kick in the abdomen; No. 1851[91], is an example of laceration of the jejunum; the bowel is seen to be completely divided; this was taken from a man æt. 37, who was run over by a cart, and lived twenty-four hours; and, lastly, the specimen marked 1851[87] is from a case that occurred in the practice of my father, the late Mr. T. E. Bryant, of Kennington; it is a portion of ileum having a small perforation, produced by a blow in running against a post; a state of collapse came on, the patient did not rally, but died on the third day.

Cases are also on record in which a portion of intestine has sloughed after an injury, and subsequently passed per rectum, a recovery taking place. In the Anatomical Museum of the University of Edinburgh several such preparations exist.

Ruptured duodenum.

The duodenum is rarely ruptured, its position protecting it; nevertheless such an accident does occur. Taylor, in his 'Med. Jurisp.,' gives a case where a boy æt. 13, after a blow on the abdomen, walked a mile with but little assistance; when he died thirteen hours after the accident the duodenum was found to be completely ruptured across.

Ruptured jejunum.

The jejunum is doubtless more frequently ruptured than any other part of the intestines, its fixed position rendering it liable to be torn away from the duodenum by any injury such as the passage of a wheel. Poland gives fourteen examples, and in half of them the laceration was at its upper part. In one case, three or four pints of thin pink-coloured fluid was found after death in the abdomen, probably the iced water of which he had freely partaken after the accident. In all, death took place from collapse and peritonitis.

Ruptured ileum.

The ileum is also frequently ruptured, and most commonly from a direct blow or fall on a hard body. In the majority of cases there is no external mark of injury, fæcal effusion and peritonitis are the usual causes of death. When the rupture is large little hope exists of a recovery; when small, such a hope may be entertained.

Blow on hernial tumour.

When a patient is the *subject of hernia* and receives a blow upon the tumour, a ruptured intestine may doubtless take place. Aston Key made this the subject of a memoir in the 'Guy's Reps.,' for 1842, and Poland has collected many such cases in the same periodical for 1858. Rupture of the gut is the usual result, and when it occurs a fatal termination is to be expected. When the bowel is only bruised it may recover or slough, giving rise to an artificial anus.

In none of these cases should any attempt at reduction be made, when symptoms of inflammation or of injury are severe. The Surgeon should, however, explore the sac. In all recorded cases where the bowel was returned, a fatal result took place.

Ruptured large intestine.

The *large intestine* is rarely ruptured from violence. When over distended, such a result may take place; but under ordinary circumstances it is too well protected.

Treatment of ruptured intestine.

Treatment.—The chief point to insist on is the absolute necessity of treating *every case* of injury to the abdomen with excessive caution; for very severe mischief may be caused by violence, and yet the immediate symptoms may not be marked. Collapse after the injury, as has been shown, is by no means a necessary consequence; rupture of the intestine itself taking place without exciting such a condition; indeed a patient may walk after a ruptured liver or intestine. The Surgeon should, therefore, be guarded in his prognosis, careful, watchful, and expectant in treatment.

Rest.

In every case secure and maintain absolute rest. If the injury be slight, by such treatment convalescence will soon be established; if severe, secondary bad results may be prevented, and at any rate will be relieved. Under two weeks no case of abdominal injury can be pronounced well.

Opium.

If local tenderness exists, fomentations or cataplasms should be used; and if this amounts to pain, leeches in good numbers—twenty or thirty—must be applied and opium given; this valuable drug should be administered in small and repeated doses, for it answers many purposes—it allays pain, and assists wonderfully in maintaining rest to the injured peritoneum and viscera, tending materially to arrest inflammatory action.

Starvation.

Ice.

The patient should be kept free from all excitement, and as little nourishment administered by the mouth as will suffice to sustain life; if the intestines are believed to have been ruptured, *starvation* must be carried out. What is given should be liquid and cold. Milk and ice is the best and simplest combination, and upon this life will be sustained without difficulty. If great thirst exists, a little ice may be given; but this must be administered with great caution, as a case already quoted well illustrates. When the intestine is believed to be injured, the allowance of fluid must be most scanty; the patient's powers may be kept alive by enemata of beef tea administered in small quantities—three or four ounces repeated at short intervals.

Never administer purgatives.

On no account administer a purgative. This rule is a golden one in these cases, and should never be deviated from; as by doing so in a careless moment, the whole of nature's processes in repairing the injury may be undone, and irreparable mischief follow. Constipation is the sign of a condition of bowel towards preserving which all our treatment is directed when keeping them at rest; a purgative is nothing but an irritant, and is in its effects absolutely destructive.

Cautious prognosis.

In all cases the prognosis and treatment should be most guarded, cautious and expectant; perfect rest, locally and generally, should be maintained, and all sources of irritation removed and kept away; by such treatment, and such alone, can recovery be anticipated, and nature's processes of repair fully carried out.

Always examine the bladder.

In all cases of abdominal injury *look to the state of the bladder*, for retention of urine from disturbed nerve influence is a common accompaniment of such cases and should not be overlooked.

Ruptured kidney.

Symptoms.

Rupture of the kidney is an accident from which recovery is more common than from that of any other viscus. Its position in the loins, outside the peritoneal cavity, is doubtless a sufficient explanation of this fact. When not very severe, and uncomplicated with other injuries, such cases usually do well. It is generally known by an attack of hæmaturia following a blow in the lumbar region, local pain as a rule coexisting. The hæmaturia may be only passing, and cease after the lapse of two or three days, when it is probable that only a contusion of the kidney had taken place, for in severer injuries the bleeding lasts fifteen days or more. At times clots will be passed, assuming the shape of the ureter. I have before me the notes of some half a dozen cases in which these symptoms were present, and from which recovery took place. Retraction of the testicle is an occasional symptom and pain in the course of the ureter.

Treatment.

The treatment pursued was rest in bed and milk diet. In one instance, where the bleeding was profuse, a grain of the acetate of lead was given with half a grain of opium three times a day. Gallic acid in ten-grain doses is also a good drug under similar circumstances. Opium must be given with caution.

When the organ is crushed, the injury is likely to be complicated with other mischief, and under such circumstances peritonitis and hæmorrhage, singly or combined, generally prove fatal. When the organ is single and becomes injured a fatal result is also likely to occur. In page 125 of my 'Clinical Surgery' I have recorded such a case.

When peritonitis exists, opium is of great value; where urinary abscess in the loins follows, as it occasionally does, particularly in gun-shot wounds, the Surgeon must make a free incision into it; a deep incision on the outer border of the quadratus lumborum muscle may be fearlessly made.

Ruptured ureter.

Rupture of the ureter was first noticed by Stanley in the 'Med.-Chir. Trans.,' vol. xxvii, where two cases are related, a fluctuating tumour formed by the effusion of urine existing in both. Poland, in the 'Guy's Rep.' for 1868, has recorded a third case. Beyond these no others are on record. Four cases of wounded ureter are, however, published by Hennen ('Mil. Surg.'). It seems in all these cases the ureter was ruptured by stretching, its renal end having suffered.

Symptoms obscure.

The symptoms are very obscure, particularly where no external wounds exist; indeed, there are none to indicate the nature of the accident in its early stage. At a later period a lumbar tumour may appear of a cystic nature, caused by the retention of the secreted urine and there may be more or less peritonitis; when this appears there is little doubt that a free opening into it in the loin is the correct treatment. Under other circumstances the case must be treated, as all others of abdominal injury, by rest and opium.

Ruptured gall-bladder.

Rupture of the gall-bladder has been recorded as the result of accident, and when it occurs death is usually rapid. The accident is marked by extreme collapse and pain in the seat of injury. Poland, in his 'Fothergillian Prize Essay,' has given us such a case, and Dr. Fergus, in the 'Med.-Chir. Trans.,' vol. xxxi, has recorded another. In one case death occurred from collapse, in the second from peritonitis.

Ruptured hepatic duct.

Rupture of the hepatic duct may also occur. In Poland's Fothergillian Essay an instance is recorded: it occurred in a boy as the result of a blow on the abdomen, and the accident was quickly fatal. My friend Dr. Sutton has kindly given me the details of a second case, which took place in the London Hospital in 1867. It was in a man, æt. 29, who was knocked down, the wheel of a spring dray passing over his stomach. He felt pain in the right hypochondriac region directly, and "had hard work to get his breath." Abdominal pain increased and jaundice appeared, and for one month he kept his bed. On the thirtieth day after the accident, as he did not improve, he was admitted into the London Hospital, under Dr. Herbert Davies and Dr. Sutton. When in the hospital he had abdominal pain, tenderness, and distension. There was distinct ascitic fluctuation over the abdomen, and deep jaundice. He sank eight days after his admission, thirty-eight days after the accident. The autopsy revealed the fact that the hepatic duct was torn across a quarter of an inch above the spot where the cystic joins the common duct; no other part of the liver was injured. The abdominal cavity contained quarts of olive-green bile-stained fluid, and the peritoneum was covered with yellow matter, of the colour and consistence of paint, which was found to be inspissated bile.

Ruptured urinary bladder.

Rupture of the urinary bladder without fracture of the pelvis is also met with, as the result of some abdominal injury, and when it occurs, is usually due to external violence applied to a distended organ. As a rule the rupture takes place at its posterior wall, the urine escaping into the peritoneal cavity, and rapidly causing death; in exceptional cases it affects the anterior wall, when the urine infiltrates the cellular tissue of the pelvis. Birkett tells us ('Holmes's Surgery,' vol. ii) that, with three exceptions, all the cases recorded terminated fatally. In one only of these three was the peritoneum involved (Chaldecott's case, 'Prov. Med. Surg. Journ.,' 1846), in the other two the extravasation was into the pelvic connective tissue. Dr. Stephen Smith, of New York, in an able monograph, 1851, reports five cases of recovery out of seventy-eight, these figures not including one of Birkett's (Porter's case), consequently the recoveries reported may be taken as six.

Seat of rupture.

Results.

Symptoms.

The symptoms of the injury are mostly collapse preceded by severe abdominal pain and ineffectual attempts to micturate. Should life be prolonged peritonitis more or less acute will appear. Dr. Smith reports three cases in which the inability to urinate continued, and twelve in which it returned on the second or a later day.

Rupture of the bladder with fracture of the pelvis likewise occurs.

Should the Surgeon be induced to pass a catheter from the ineffectual efforts of the patient to pass urine, it will often happen that no success will be achieved, but in some cases a vast amount of fluid will be withdrawn, the catheter under these circumstances having doubtless been passed through the rent in the posterior wall of the organ into the peritoneal cavity. I have known a case where several pints of fluid were drawn off under these circumstances.

Treatment.

TREATMENT.—When any time exists for treatment the indications are to *allow of a free exit for the urine as secreted*, and to check peritonitis. A certain amount of peritonitis must be looked upon as beneficial, for it tends towards the first indication of treatment, the prevention of extravasation, but any excess of action requires prompt treatment. Opium is without doubt the best drug to promote this end, a full dose of the solid opium or the tincture being given, and followed up to maintain its action; absolute rest, local fomentations, and possibly leeches are valuable adjuncts. As little food should be given as is absolutely necessary to maintain life, and ice in moderation to allay thirst. The bladder should be kept empty, the maintenance of a large catheter in the viscus, with an opening in the end, being the best method, according to Birkett; but it seems probable that a free incision through the perinæum into the organ, as in lithotomy, is the better practice. When the bladder is ruptured from a fracture of the pelvis, the same treatment is called for.

Opium.

Use of catheter.

Injury to uterus.

Injury to the uterus, when large from pregnancy, deserves a passing notice, for such cases are serious. A contused organ may inflame, and be followed by absorption or miscarriage, or should pregnancy continue, its structure may be so altered as to be liable to rupture. I have known also an intra-uterine fracture of a child's thigh to take place as a consequence of a fall. In obstetric works also cases are recorded in which a distinct rupture of the organ followed.

Ruptured ovarian cyst.

Rupture of an ovarian cyst from a blow is also recorded, and under certain circumstances a good result may take place; all obstetricians have met with such cases; as a rule, however, a fatal peritonitis follows.

Ruptured diaphragm.

Rupture of the diaphragm is an accident that occurs in practice, but is difficult to diagnose; it is generally the consequence of some violent injury, such as a crush, or the passage of a heavy wheel over the waist. In such cases the injury is complicated, and usually with hernia of the abdominal contents into the thorax. This injury can only occur on the left side. Dr. Wilks, in the 'Lancet' for 1858, reported three instances of this diaphragmatic hernia, and pointed out that *excessive thirst* was the most prominent symptom in each. I had the opportunity of seeing these three cases and others since have come under notice, and this symptom seemed to be most characteristic; the thirst was insatiable. In January, 1872, a similar case came under my care, and this symptom was well marked.

Wounds of the Abdomen, involving Parietes and Viscera.

The parietes of the abdomen are often wounded by sharp substances, whether by accident or design, and so long as the wounds are confined to the parietes the danger is small. When the peritoneum is punctured or perforated the viscera are also probably involved, and under such circumstances the case becomes a serious one. In rarer cases the intestines protrude, when an additional element of danger is added.

Wounds of the parietes.

Wounds of the parietes alone require the same treatment as wounds of any other part. The surface should be well cleansed, and all foreign bodies removed. Hæmorrhage should be arrested by torsion or ligature and the edges of the wound brought together with sutures. In deep wounds, where the risk of suppuration between the muscles or fascia is great, absolute rest in the horizontal position should be enjoined, the muscles being thus relaxed. When suppuration appears the Surgeon must be careful to let out all fluid, either by reopening the wound, or by a fresh opening. In all wounds of the parietes the Surgeon should be particularly careful to arrest bleeding at once, and let out anything like pus as early as possible. *All punctured wounds should be left open;* when bleeding persists the wound should be enlarged and the vessel secured.

Penetrating wounds of the parietes.

Penetrating wounds.

Diagnosis difficult as to extent.

There is always a difficulty in diagnosing these cases; that is, in making out the true nature of the accident, more particularly in punctured wounds. When the depth of the wound is known by the extent of insertion of the offending body, and the relative position of the viscera at the wounded spot also, some notion as to its nature may be formed; but when no such guide is to be found, the Surgeon has to rest upon other evidence, or upon surmise and probabilities; as a rule, where want of evidence is felt, it is well to treat the case as a serious one. All penetrating wounds are serious, whether incised, lacerated, punctured or gunshot. Punctured wounds are by far the most common.

Symptoms when viscera injured.

Collateral evidence important.

When the viscera are *uninjured,* beyond the the parietal wound, there will be a total absence of all other symptoms, *and these negative symptoms afford the best positive evidence of the simple nature of the wound.* When the viscera are injured there will generally be syncope, more or less lasting, or collapse; there will probably be severe local pain, soon becoming radiating; there will frequently be vomiting, possibly of blood, or the passing of blood from the bowel or bladder. If life is prolonged there will be peritonitis. When the bowel or omentum protrudes, when the fæces, bile, urine or blood appear at the wound, the evidence is clear. The Surgeon will, however, find much help from collateral evidence in forming an opinion; thus, the size of the wound compared with the instrument that inflicted it; the position of the blood stain on the instrument; the force with which the blow was struck; the direction of the force in relation to the position of the patient; the thickness of the abdominal parietes. By all these means an approximate opinion may be formed, but in no case can a positive diagnosis be made with certainty. Under all circumstances, however, the *treatment* must be the same.

Treatment.

Rest.

Opium.

Low diet.

Local treatment.

Rest.—Absolute rest being an essential point, no movement should be allowed, not even for passing the evacuations. *Opium* in moderate or full doses, according to circumstances, is also demanded, it being well to keep a patient under its influence for several days, by giving one grain every four or six hours. *Low* diet, that is, milk diet, should be allowed, all food being given cold and in small quantities; ice to suck is refreshing. *Purgatives* should on no account be given till the nature of the case is declared. With respect to *local treatment,* the greatest simplicity should be employed. The wound should be cleansed, and all bleeding vessels secured, but anything like an exploration of the wound is to be condemned. All probing, fingering, or manipulating the wound should be avoided as dangerous and only pertaining to surgical curiosity.

Sutures.

The abdominal muscles should always be relaxed by position, and the edges of the wound, when it is large, brought together by sutures. Water dressings should then be applied. Punctured wounds when perforating, like others, should be left open. Even after the lapse of some days, when no symptoms of wounded viscera appear, the same caution should be observed, two or three weeks being always allowed before freedom is given. Under all circumstances the condition of the *bladder* should be inquired into.

Penetrating Wounds, with protruding Viscera.

General remarks.

It is hardly necessary to say that the special risk of any of these cases is determined greatly by the viscus that is involved, and the amount of injury it has sustained. Thus, a penetrating abdominal wound with protruding omentum is far less dangerous than when hernia of the intestine exists, and a wounded bowel is of graver importance than an uninjured one. It is consequently necessary for the Surgeon in all these cases to run over mentally the position of the viscera, in order that he may form an opinion as to the probabilities of the case. Fig. 226 will refresh his memory on these points.

"Of the hollow viscera any portion of the intestinal canal may be protruded, from the stomach to the sigmoid flexure, according to the situation and degree of distension of the viscera. The small intestines most frequently, next the large, then the stomach, and, lastly, the cæcum. Of the solid viscera the omentum is by far the most common, and is often associated with that of the viscera." (Poland's 'Prize Essay.')

In *small* wounds a limited hernia of the abdominal contents can alone take place, and when it occurs the protruded viscera are very prone to be strangulated by the wound.

In *large* wounds the hernia will probably be of greater extent, and their constriction is rare.

Protruded omentum.

Treatment.

When omentum protrudes from a recent wound, and no injury to it has been sustained, it should be washed by means of a small stream of water squeezed over it from a sponge or emitted from a syringe, and returned with all gentleness, the muscles of the part being relaxed. The wound should never be enlarged to allow of the return of omentum. When the omentum has been extruded for some time, and is congested from incarceration or strangulation, when it has become inflamed, or perhaps sloughing, it is well to leave the mass alone, at least it is not wise to make any attempt at its reduction. As time goes on, and the projecting mass swells and granulates, it may be well to ligature the whole in halves; this should not, however, be done for at least two weeks after its protrusion. During this time the greatest quiet is to be enforced, and moderate doses of opium should be given, liquid food being allowed. After a few days all fear of peritonitis will have passed. Some Surgeons prefer not to interfere with the protrusion, for sooner or later it will probably wither up, but such a process is tedious. The application of a ligature to it in halves is rarely attended with any risk, and may be undertaken. Should the omentum be much bruised or torn at the time of injury, such injured portions may be cut off, all divided vessels being secured.

Protruded bowel uninjured.

When the bowel protrudes through the wound, and is *uninjured* and whole, it should be cleansed and *returned under all circumstances,* the wound being carefully enlarged in the course of the muscular fibres for the purpose, should its reduction be impossible without. To facilitate this the muscle should be relaxed, and the parts last descended returned first. In returning the intestine the pressure should be directly backwards; if made obliquely, the bowel may be pushed up beneath the fascia or muscles, and thus outside the peritoneum. The wound should be closed by sutures, and treated as already described.

FIG. 226.

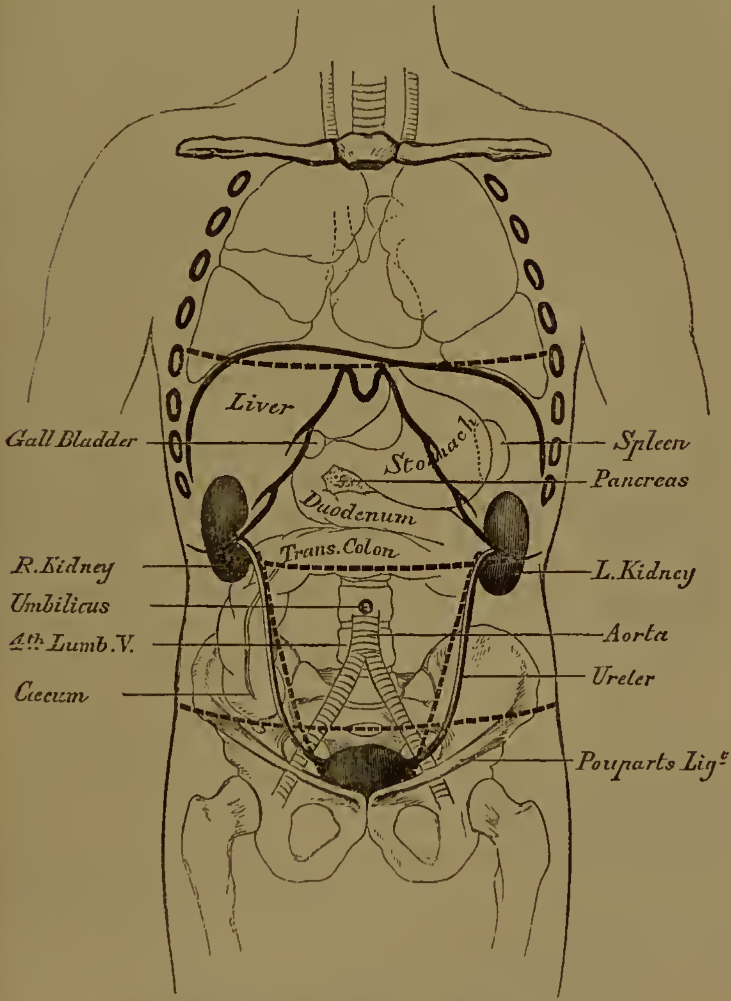


Diagram showing the positions of the abdominal viscera.

When the protruded bowel is *gangrenous*, that is, irreparably so it must be left *in sitû*, to slough, and for an artificial anus to form, the wound in the abdominal parietes being enlarged; where there is a prospect of its recovery the abdominal cavity is the best place for it.

Protruded bowel and injured.

When the intestine is wounded, and the opening a mere prick, through which no intestinal contents exude, the bowel may be returned, a few hours being enough for the wounded part to become sealed by plastic exudation, and repair to be completed. When the mucous lining protrudes, the opening should be tied by a single ligature. When the wound is sufficiently *large to permit of the escape of the visceral contents,* it must be stitched up with one of the forms of suture seen in Fig. 28 or 227, and then returned, the ends of the sutures being cut off close.

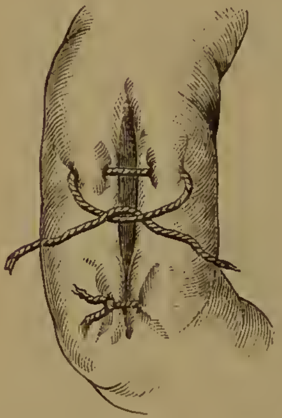
Wound involving nearly whole calibre.

Sutures.

Fixing to external wound.

When the wound *involves nearly the whole calibre of the bowel,* it is a wiser plan to bring the edges of the bowel to those of the wound, and stitch the two together, thus making an artificial anus, than to stitch the two divided ends of the intestine together, and return the whole into the abdominal cavity. Pollock ('Holmes's Surgery,' vol. ii) says if the division be caused by a clean sharp instrument, the extremities may be brought together with sutures and returned; but if the separation be the result of an irregular lacerated wound, as from gunshot, &c., we should not hesitate to fix the edges to the external wound, and risk the chance of an artificial anus. When the bowel is stitched to the edges of the external wound care should be taken to maintain the line of the canal as much as possible and not to draw the intestine more out of its position than is absolutely necessary to maintain the orifice outside the abdominal cavity.

Fig. 227.



Illustrating one form of application of suture to the intestine. The thread is made thick for the sake of clearness.

For another *vide* Fig. 28, p. 146.

The general and local treatment of all these cases is similar to that already laid down for the treatment of other abdominal and visceral injuries.

Wounded viscera without protrusion.

Result.

Penetrating abdominal wounds complicated with wounds of the viscera, but without protrusion, are, without doubt, far more serious than any that have been hitherto considered, and their effects depend greatly upon the condition of the viscus when wounded. Thus the puncture of a distended stomach, intestine, or bladder, will to a certainty be followed by extravasation into the abdominal cavity, and, as a result, by great shock and diffuse peritonitis; whereas these organs, when contracted, may receive a limited injury without any such consequences taking place, *local* inflammation rapidly arising under these circumstances and sealing the wound.

Case.

Nevertheless, remarkable cases of recovery after impalement are on record, and not the least is that of a boy, æt. 11, who fell upon a rick-stake, the stake penetrating his body for seventeen and a half inches; it entered the abdomen beneath Poupart's ligament in the *right* groin, traversed the abdominal cavity to the left side, and then entered the thorax, perforating the diaphragm, displacing the heart and pushing it to the right side of the sternum, piercing the left lung and passing out of the chest between the seventh and eight ribs into the axillary space. The stake was removed four hours after its introduction, and not a teaspoonful of blood was lost. Some intestine protruded from the wound in the groin, but was replaced, the inguinal wound being stitched up. Opium was freely given subsequently with calomel, and in six weeks the boy was able to sit up and play and eat his ordinary food. Five months after the accident the boy was free from pain, and was able to walk about. The case occurred in the practice of Mr. Reynolds, of Thame, Oxon, and is recorded in the 'Med. Times and Gaz.,' Sept. 23, 1871. The chief risks of wounds of the viscera are hæmorrhage when the solid organs are implicated, and extravasation when the hollow. When the contents of the wounded organ escape externally through the wound, the danger of the case is undoubtedly lessened. When the *stomach* is supposed to be wounded by a puncture the utmost care is called for by the Surgeon to prevent the administration of any food; *nothing* should be put into the stomach for several days, life being maintained by nutrient enemata; for to excite any action of the organ would be to undo what nature can do for repair of the injury, and jeopardise life by increasing the risk of extravasation.

Escape of contents through external wound.

When the *intestine* is *wounded*, or suspected to have been wounded, the same care is called for, although ice, or iced milk, in limited quantities, may be allowed to satisfy thirst.

Opium.

Opium should of course be given, and it is best administered by suppositories, the morphia suppositories of the pharmacopœia being the best preparation to employ in all cases of abdominal surgery. The principles of treatment are, however, the same as have been laid down in former pages. In all penetrating wounds of the abdomen in which any evidence of wounded viscera exists, the *local wound should be left open*, or covered only with a loose covering; for to close the wound so as to prevent the escape of the contents of the wounded viscus externally would be to close the only gate through which return to health is possible.

Wound to be left open.

Abnormal Anus, Fæcal Fistula.

Fæcal fistula.

Confining the term "*artificial anus*" to the surgical operation of forming an anus otherwise than natural for the relief of intestinal obstruction, &c., an "*abnormal anus*," or intestinal fistula—*fæcal fistula*—or an unnatural communication between the intestinal canal and the outside of the body, is generally the result of a sloughing or ulcerating bowel in strangulated hernia; but it may occur from a wound of the intestine from some external cause, or from a perforation of the intestine from an ulcerating process originating from within.

When it follows a hernia, the opening is usually at the neck of the hernial sac; when it follows a wound, at the seat of injury; when it is the result of some ulcerative process originating from within, the fæcal abscess may burrow into the pelvis (opening into the vagina, bladder, or even bowel again), or between the abdominal muscles, making its appearance in the groin, iliac fossa, or loin. When the opening is a *large* and *direct* one into the bowel it has been called "artificial anus;" when small, indirect, or fistulous, "fæcal or intestinal fistula."

When wound small.

The most important point, however, connected with this subject has reference to the amount of intestine involved; when only a small portion of its calibre has been lost, the fistula will generally be small; when a large portion of its calibre or a whole knuckle has been involved, the fæcal orifice will be large. Under these circumstances the two orifices communicating with the upper and lower ends of the bowel respectively can generally be made out, a fold of membrane formed by the junction of the bent tube standing as a partition between the two portions of the gut. At times this partition will project so far forward as to close completely the orifice of the lower part of the bowel, and this is the usual state of affairs when a complete knuckle of bowel has been involved in the disease, and under such circumstances a cure by natural processes is almost impossible. At other times the partition will be but limited, and a portion only of the contents of the bowel will pass externally, the other portion taking its normal course downwards towards the anus, when it is more than probable that nature alone, or but slightly assisted by art, will effect a cure. When the orifice is large there is almost always some prolapse of the bowel. Under all these conditions the intestines within the abdomen are closely connected by means of adhesions to the external orifice; the serous surface of the intestine becoming firmly fixed to that of the opening in the abdominal parietes. Beyond these adhesions it is a rare thing to find the other coils of intestine adherent about the part; but, on the contrary, the parts are otherwise usually so free that coils of bowel will be found separating the two portions of intestine that are adherent at the wound, and may so dip down between them as to push forwards a serous sac into the artificial opening, and even form a hernia. The nature of the discharging fluid will fairly indicate the position of the bowel that is involved: when well-formed fæces pass, the large or lower part of the small intestine is probably the seat; when the fluid is thin and inoffensive the jejunum is indicated. The yellow semi-fæculent contents of the ileum can generally be recognised. The nearer the opening is to the stomach the worse is the prognosis, for nutrition under such circumstances must be seriously interfered with. The nearer it is to the lower end of the canal the better are the prospects of life.

When wound is large.

Position between the two ends.

Prolapse of bowel.

Discharge from bowel a means of diagnosis.

Prognosis.

Treatment.

TREATMENT.—When the orifice is fistulous and the canal is fairly open for the passage of fæces, a cure may with some certainty be looked for by natural processes; in the artificial anus *after the return of a small hernia into the abdomen*, and particularly of a femoral, such a result is by no means unusual, and the Surgeon has little more to do than to keep up the strength of his patient—give simple nutritious diet, maintain perfect cleanliness of the wound, and apply gentle pressure to the part. When the fistulous communication is larger the same treatment must be employed, although with less hope of success. Indeed, except with small openings, there is no hope of a natural recovery. Lawrence recommended the constant use of a truss in these cases to prevent prolapsus, and Pollock strongly advocates the importance of the recommendation, adding, that "a compress of linen placed on the opening, with a larger pad over it, and a truss applied over the whole, will, in a great measure, restrain the contents as well as prevent the protrusion of the bowel."

Palliative.

Use of truss.

To assist the contraction of small fistulæ the edges may be cauterized, or even pared, a plastic operation being justifiable under certain circumstances.

Surgical interference. Dupuytren's operation. 'Mém. de l'Acad. de Méd.,' 1828.

With respect to surgical interference in these cases, the recommendations I have to give are not very satisfactory. Dupuytren suggested an operation to get rid of the projecting fold or septum that has been described. He did this by an instrument called an enterotome, a pair of forceps with one blade grooved, into which the other closed. The approximation of the blades was regulated by a screw. The septum was crushed between the blades and so held till its destruction was effected. The instrument, as a rule, came away about the seventh day, and, Dupuytren says, "by the division and loss of substance, the ridge and the double septum which separate the two ends of the bowel are destroyed so as to re-establish the interrupted communication between them, and restore the natural course of the aliment and fæces." Jobert advises the pressure of the instrument to be gradual, fatal cases having occurred when Dupuytren's rapid process hae been employed. The theory of this operation is very good; it is one, indeed, based on nature's own processes; for I have seen the septum of an artificial anus ulcerated through by natural processes, leaving an opening through which fæces passed from the upper to the lower bowel, a narrow band above alone existing to prevent a freer fæculent flow. The success of the operation has been also good; out of forty-one operations recorded by Dupuytren, twenty-nine cases recovered, nine were relieved, three died. In this country the operation has been little practised. In 1869, Dr. Buchanan of Glasgow recorded a successful case. ('Edinb. Med. Jour.')

Success of operation.

When fæcal abscess formed.

When a *fæcal abscess* has formed in the abdominal walls, the sooner it is opened the better, and when opened the incision should be a free one. In abscesses connected with the *cæcum* or its *appendage* this rule is an important one. For intestinal fistula opening indirectly into the *vagina* little surgically can be done beyond attending to the general condition of the patient, giving nutritious food, but not such as is likely to distend the bowel, and observing perfect cleanliness of the passage, increasing the external opening should anything like retained pus exist. Under these circumstances a natural recovery may take place. In recto-vaginal fistulæ plastic operations are most successful.

When bowel ulcerated into bladder.

When the *bowel* has ulcerated into the bladder natural processes appear to be rarely capable of effecting a cure, and, under such circumstances, to save the patient from the miseries which the passage of solid fæces into the bladder causes, the operation of colotomy may be entertained. I have performed this operation on four occasions with success, the operations in all giving great relief. One of my patients is now (1876) alive free from all pain, the operation having been performed on July 5th, 1870 ('Clin. Soc.,' 1872). In another case operated upon on August 16th, 1869, the gentleman lived to March, 1875, dying from heart disease. The third died from some disease in the kidneys some months after the operation ('Med.-Chir. Rev.,' 1869). The fourth died some weeks after from the cancerous affection for which the operation was demanded, but free from all pain.

Foreign Bodies in the Stomach and Intestines.

Foreign bodies in the stomach and intestines.

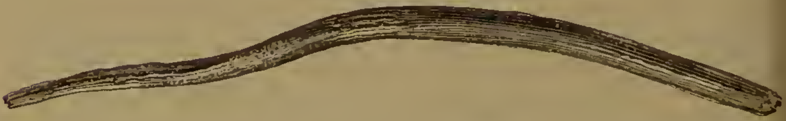
Foreign bodies are often taken into the stomach both from accident and design; and the records of cases prove to us that from the absence or the mildness of symptoms, no Surgeon should pronounce against the possibility of their introduction. They as often as not are passed per anum without giving rise to very distressing symptoms; but when retained they contain nothing but evil. *Smooth hard bodies* such as coins and stones, as a rule, pass readily without giving rise to any symptoms or to other than slight colic. But *sharp* and *pointed bodies*, such as bones, pins, knives, &c., give rise to symptoms that vary according to the position of the intestine at which they become impacted.

At times intestinal calculi form, from the agglomeration of hair, husk, particularly oat husks, or other foreign substance, and prove fatal. Dr. Down has recorded such a case ('Path. Trans.,' 1867), in a boy, æt. 13, who died of exhaustion after fifteen days' illness. Not many years ago I saw an artist, æt. 36, who died from intestinal obstruction, through whose abdominal walls a globular indurated mass was readily felt on the right of the umbilicus. I suspected it to be made up of hair, for he was in the habit of sucking to an excess the paint brushes of his pupils, but the diagnosis could not be verified after death. A foreign body taken into the stomach may be ejected by vomiting, discharged externally through the abdominal parietes, retained in the stomach, or passed onwards. In Fig. 228 is illustrated a piece of iron wire that was swallowed by a female lunatic, æt. 56, on March 10th, 1873. The symptoms that followed the act were so slight that some doubts as to the occurrence existed, and it was not till May 15th, when a swelling was detected in the right of the umbilicus, that the history was credited. The swelling rapidly increased, and opened on May 20th, the point of the iron wire projecting. This was withdrawn by the Surgeon in attendance, Dr. T. B. Dyer, of Colney Hatch, and a rapid recovery followed, no single bad symptom making its appearance. My friend Mr. Lund, of Manchester, has recorded a very similar case in the 'Liverpool and Manchester Med. Surg. Reps.' for 1873. When retained a foreign body may rest without giving rise to very serious symptoms—a rare result—or set up ulceration, which may in its turn give rise to a fatal peritonitis. In the more fortunate it will be passed on through the canal and discharged.

May be ejected by vomiting.

Discharged externally.

FIG. 228.



Piece of iron wire discharged from abscess in abdominal walls after having been swallowed. Natural size.

To prove these points the reader may refer to Mr. Pollock's article in 'Holmes's System,' vol. ii, where he gives a case in which a lady vomited a gold plate three quarters of an inch long, with two false teeth, after it had been lodged in the œsophagus for nineteen, and in the stomach for ninety-seven days. Another case is that of Mr. Taylor, of Edinburgh, in which a patient *passed per anum*, three days after swallowing it, an artificial plate with six teeth one inch and three quarters long. And a third case is on record in which a lady passed, per anum, a plate two and a quarter inches in diameter, with four teeth, six months after she had swallowed them.

May pass per anum.

In the Guy's Museum (prep. 1800) there is an enlarged and thickened stomach of a sailor who had swallowed clasp knives. He was æt. 23, and in June, 1799, he swallowed four clasp knives; these were discharged

May be retained.

from the bowels. In March, 1805, he swallowed from fifteen to twenty more. His health became impaired. He vomited the handle of one and passed portions of the blades of others. In March, 1809, he died in a state of exhaustion. After death one blade was found perforating the colon opposite the kidneys, but without extravasation of fæces. Another was fixed across the rectum; in the stomach were numerous blades partially dissolved—thirty or forty fragments in all.

Poland has also recorded in his prize essay the case of a lunatic who died from ulceration of the duodenum due to the pressure of a spoon handle that had been swallowed three months or more before, with *thirty* others, along with nails, pebbles and pieces of iron, extracted from the stomach after death, and weighing in all forty ounces. But the most complete list of cases of foreign bodies in the digestive canal will be found in the 'Union Médicale' for November, 1874, by Dr. Mignon.

Treatment.

TREATMENT.—When a foreign body of moderate dimensions has been swallowed the usual practice is to give a purge; but it is, however, a wrong one. The "smasher," who constantly swallows false coin, when caught in the act of passing it, according to Pollock, avoids *purgatives*, but takes a constipating diet, such as hard boiled eggs and cheese, together with his usual food, thinking that the money is more likely to be caught and consequently passed in a bulky stool than in a liquid one. The Surgeon should act on this principle. When the foreign body becomes impacted, whether in the stomach or intestine, or sets up by its presence an inflammatory action and peritonitis, the Surgeon may entertain the thought of opening the abdomen; that is, he may assist natural processes when these are doing their best to get rid of the foreign substances by ulceration. When the foreign body is large and clearly cannot be passed, the Surgeon should open the stomach by *gastrotomy*, ten cases out of eleven in which this operation has been performed having recovered. (*Vide* paper by Dr. Pooley of New York, 'Richmond Med. Journ.,' April, 1875.)

Gastrotomy and Gastrostomy.

Gastrotomy and gastrostomy

When the stomach has to be opened for the removal of a foreign body the operation is rightly described as that of "gastrotomy." When the same operation is performed with a view of establishing a permanent fistula for the introduction of food, as first performed by Sédillot in 1849, and described by him as gastro-stomie, the term "gastrostomy" seems to be the more applicable.

This change has been suggested by Dr. Pooley, of New York, and it seems so good that I now adopt it.

That the former operation is not necessarily fatal is proved by the fact that it has been performed at least eleven times, and in ten with success, and although in the twenty cases in which the latter has been undertaken life has been never prolonged for more than forty days (Sydney Jones's case, 'Lancet,' May 15th, 1875), the evidence of the relief that it has afforded to those who have been subjected to it is enough to prove that it is based upon a sound principle and a humane practice, for it is to be remembered that it is undertaken more with a view of mitigating the horrors of a death from hunger and thirst, and of prolonging what remains of life than from any curative object, although even in the latter point of view it may be required. I have had an opportunity of watching the progress of three cases under the care of my colleagues Messrs. Cooper Forster and Durham and of two under my own care; and I am free to confess that the advantages given by the operation were worth the risk, and that if life was not prolonged it was certainly rendered more endurable.

Arguments in favour.

We perform colotomy for a patient with cancerous stricture of the intestine or other mechanical obstruction without hesitation; and Surgeons are now willing to admit the great advantages afforded by this measure. Surely the advantages offered by gastrostomy for stricture of the œsophagus, cancerous or otherwise, are not less potent, and *should it be undertaken before the patient's powers have been brought to too low an ebb*, there is no reason why it should not be equally effective. In one of my own cases the man lived five days; the operation had nothing to do with the death, and the local repair was most complete. In the second case he lived two days. The operation has not been hitherto successful, I believe, because it has been put off until too late a period; in the same way as colotomy was unsuccessful till it was undertaken at an earlier stage of the disease. Let gastrostomy have the same chance as colotomy has now had, and it will become as established an operation in surgery.

Description of the operation.

The operation.—Chloroform had better be given, as it is important that absolute quiet be maintained during the operation, although the risks of vomiting as a consequence are not slight. The patient should be placed upon his back, and an incision made below the ribs on the left side, the object of the Surgeon being to find the cardiac end of the stomach in preference to the pyloric. The line of the linea semilunaris is the ordinary one used for the incision, a cut three or four inches long being made carefully through the tissues seriatim down to the fascia lining the muscles, every vessel being twisted or tied as it bleeds. In my own operations I made an oblique incision along the lower borders of the ribs, commencing at the linea semilunaris, with the view of catching the cardiac end of the stomach, and I may say that I picked the stomach up with my fingers very readily; the fascia and peritoneum are then to be divided. With the thumb and finger the stomach is now to be sought, and when caught, held. This is best effected by the passage of a needle armed with a double silk ligature through its coats, the silk being left with long ends; a second should also be passed about three quarters of an inch lower down. The Surgeon has then to fasten the stomach to the margins of the wound, and the quill suture seems to be the best means to use. To do this he may first pass the needles that have already traversed the stomach, and are still armed through one side of the wound, and with a second needle draw the free ends of the ligatures, when threaded, through the other. The stomach should then be opened over the ligatures that have been passed through it, the incision being made in the line of the wound; the centre of the double ligatures will then be exposed, and these should be drawn well out and divided. There will then be two double ligatures through each side of the opening in the stomach and the margin of the wound. On tying the two ends over two pieces of bougie, one introduced against the inner surface of the stomach, and the other upon the integument, the parts are secured, the bougies admirably compressing the thin walls of the stomach against the integuments, and retaining them there. One or

Mode of fastening stomach to parietes.

Mode of opening stomach.

two other sutures will probably be required to close the wound, and an additional one at either end of the opening in the stomach to keep it in its place; the operation is then completed. When the quill suture is not used, the stomach must be stitched to the margins of the wound in the ordinary way, but a more accurate adaptation of the parts and greater security is acquired by the quill suture than any other, and what is more, the pieces of bougie are capital guides to the orifice into the stomach, the slightest traction upon them rendering it patent for purposes of feeding; for this purpose one of the sutures should be left long on either lip of the wound. After the operation it is well to desist from giving food for a few hours, to give the stomach rest; although, after a day or so, liquid nourishment may be administered in small quantities through a tube, milk and eggs being probably the best, or milk alone. Where enemata can be tolerated they should be used. Care should be observed that too much food is not given, as it retards progress, a quart or three pints of milk in twenty-four hours being ample. The edges of the wound should be carefully protected by oiled lint. The sutures may probably be removed wholly or in part on the fifth or sixth day.

After-treatment.

It must be added that Sédillot was the first Surgeon to perform the operation in 1849, and Mr. Cooper Foster, on the suggestion of Dr. Habershon, was the first to do it in this country in 1857. Since then Mr. Sydney Jones, Fenger, of Copenhagen, Durham, Le Gros Clark, MacCormac, T. Smith, V. Jackson, and myself, have had cases, making twenty in all.

When body impacted in intestine.

When a foreign body becomes *impacted in the small intestine*, and life is threatened, it is a question how far the Surgeon is justified in attempting its removal. I can see no reason why an attempt should not be made, when the course of the case has proved that natural processes are incompetent to get rid of the offending body and life is threatened by its presence.

When the *colon, cæcum or its appendage*, is the seat of impaction there is less objection to the attempt, for *colotomy* is now known to be a valuable operation for cancerous or other obstruction of the rectum, and in cases of suppuration about the cæcum free incisions in the iliac fossa are of proved value, and they are not less likely to prove of use when the obstruction is caused by the presence of a foreign body.

Intestinal Obstruction.

On intestinal obstruction.

The Surgeon's aid is occasionally called for in cases of intestinal obstruction; and it must be admitted that there is no class of cases in which more thought and judgment are called for, for the difficulties of diagnosis as to the cause of the obstruction are always great, and the question of operative relief has to be decided upon very uncertain grounds.

Operative interference in intussusception.

In *intussusception* operative interference has not hitherto been very successful, although from recent experience good results may be looked for; Mr. Hutchinson having recorded a case ('Med.-Chir. Trans.,' vol. lvii, 1874) in which he opened the abdomen of a child æt. 2, on the thirtieth day of the symptoms, and drew out the invaginated bowel with a successful issue, and my colleague Mr. Howse in a case of Dr. Fagge's has recently (1874) met with equal success. I have likewise in a dog performed the same operation on the fifteenth day with a good result, pulling out six feet of invaginated bowel.

In internal strangulations.

For *internal strangulations*—the equivalent of an internal hernia—in which the bowel is obstructed by some solitary band, omental, mesenteric, or otherwise, a better success may be expected; for, granting that a diagnosis of a case can be made, and its almost certain fatal termination accepted, the question of operation becomes a simple one—for the cause is without the bowel and remediable—ought the operation therefore to be attempted, or is the patient to be left to die unrelieved? I have no hesitation in giving it as my opinion that an operation is justifiable under these circumstances, but only when the diagnosis is fairly clear.

Cases of intestinal obstruction.

These cases are not uncommon. Dr. Fagge, in an able article on the subject of intestinal obstruction ('Guy's Hosp. Rep.,' 1868), remarks that out of 75 fatal cases of intestinal obstruction at Guy's, in fifteen years, 17, or about one fifth, were of this nature. Dr. Brinton found that out of 600 cases of intestinal obstruction, 31 per cent. were from bands, 43 from intussusception, 17 from stricture, and 8 from torsion; and in most of these it might be said that surgical relief could have been given. There might, says Dr. Fagge, "in many cases have been no little difficulty in finding a band among the distended coils, but I regard the facts derivable from our post-mortem records as indicating no insurmountable obstacles to the success of an exploratory operation in the great majority of the cases of true internal strangulation, which are to be found in these records."

Diagnosis of obstructed bowel.

We come now to the question of diagnosis, and it must at once be admitted that in many instances of obstructed bowel, as they come under the notice of the Surgeon, it is impossible to make out their true nature, but in as many more the indications are not uncertain. The following are tolerably characteristic of the presence of a band:

Sudden onset of symptoms.

Absence of hernia or tumour.

Intensity and rapidity of symptoms.

"The sudden and definite onset of the patient's illness; the occurrence of collapse at its commencement; the comparatively early age; the severity of the pain, which is generally referred to the umbilicus; the absence of a hernia, obturator or otherwise; the absence of any precursory symptoms; the absence of tumour, hæmorrhage, and dysenteric symptoms, such as are seen in intussusception; and the absence of that extreme intensity and rapidity which belong to the more acute form of volvulus."—Fagge.

Examples.

When there has been a history of old hernia, the probabilities of the existence of a band are much enhanced, for it is true that with hernia such bands are not uncommon. Duchaussoy, in his paper "On Internal Strangulation" ('Mém. de l'Acad. de Méd.,' 1860), gives such cases. Fagge quotes one, and in my own practice three have occurred: one died unrelieved; in the second I opened the empty hernial sac, and so enlarged my incision upwards for about two inches as to detect a band high up in the abdomen, this I divided with a pair of scissors and a perfect recovery took place. The case occurred in the practice of Dr. Wilkinson, of Sydenham, and is fully recorded in the 'Med.-Chir. Trans.' for 1867. The patient is still alive. The third died after the operation, but the band was divided and a large coil of intestine released. The operation had, however, been put off too long.

Illustrative case of internal strangulation.

"If, then, we are called to see a patient under thirty years of age, who has been suffering for four or five days with symptoms of obstructed bowel, constipation, vomiting of intestinal fluid, distension of the abdomen, and mapping out of coils on its surface, and who has collapse, scanty or suppressed urine, and severe *paroxysmal* pain, referred to the umbilicus or to the right iliac fossa, which pain came on suddenly at a definite time, perhaps after the patient had made some effort or received a blow; if before this the patient had been healthy, if no tumour can be felt, and there has been no tenesmus nor internal hæmorrhage; and lastly, if the distension of the abdomen, although marked, be not excessive, under such circumstances we should be justified in treating the case as one of internal strangulation."—Fagge.

Analysis of 148 cases of obstruction by solitary band.

Mr. Gay also, in two valuable papers published in the 'Trans. of the Med. Soc. of London,' 1861-2, gives an analysis of 148 cases of strangulation by the "*solitary band.*" One hundred and two were in the male, forty-eight in the female; the largest number took place between the ages of 15 and 35; "but these bands may form at any period of life, and when once formed they may prove fatal by entangling some portion of intestine at any period up to the latest."

74 cases of invagination.

He gives also seventy-four of "*invagination*" of the intestine; in thirty-three the small intestine was the seat of trouble; in thirty-three the small intestine with or without cæcum or colon was invaginated into the colon; in eight the large intestine was alone involved. The youngest patient was a child one year old, and this was of the small intestine alone. Intussusception in children, however, as a rule, involves the lower part of the ileum, cæcum, and colon.

Symptoms of band and invagination.

In both obstruction by "band" and "invagination" the attack is generally sudden. When by a band pain is localised from the first, and paroxysmal; it remains severe to the last. When from invagination pain varies much both in seat and intensity; it is often relieved by pressure; towards the last pain ceases.

In "band," vomiting soon becomes fæcal and is constant; in intussusception it may be the same, but it as often ceases.

In "band," constipation is the rule; in invagination diarrhœa, tenesmus and bloody mucoid stools are characteristic; they are not, however, constant, as constipation is at times present.

In "band," abdominal distension is an early symptom, in "intussusception," it may never exist. In the latter also a distinct tumour may be felt.

Dr. Leichtenstein, of Tübingen, in a valuable monograph on intussusception ('Prager Vierteljahrschrift,' Bd. 119, 121, 1874), has given us an analysis of 593 cases of this affection. In this he states that in childhood intussusception of the small intestine is very rare, and that when it occurs, whether in childhood or adult life, collapse is an early symptom.

Sudden invasion of symptoms is the rule in most cases, more particularly when the ileum is involved, and muco-sanguineous discharges occur in all its forms.

He states that when a tumour is recognised in the epigastric region the ileum is probably the part that is invaginated; when in the right iliac fossa the ileum into the cæcum; when it can be felt in the rectum it is probably ileum.

He tells us also that when the intussuscepted portion of bowel sloughs off, it is generally part of the ileum, and that this result is very rarely met with in infancy; when it occurs it is about the eleventh or twenty-first day from the beginning of the disease.

Treatment of intussusception by inflation.

In intussusception good success has, however, followed the practice of *inflation.* Gorham recommended this treatment years ago, and more recently, good success has followed the practice.

Opium.

In intussusception and in strangulation from a band, *opium* should be freely given from the first, and the administration of chloroform at an early stage of this affection may assist recovery. *Inversion* of the body has been advised with the chance that the weight of the contents of the bowel above the involuted or obstructed segment may suffice to disengage it. *Operation* in intussusception has been now proved to be justifiable. In the very early stage it might do good before the invaginated bowel has become adherent, and Gay tells us that this does not take place for four or five days after the first symptoms, and may not for ten. But in the early period the diagnosis is too uncertain to allow of such a proceeding, and the chances of a natural cure have not passed away. For cases of intussusception occur and pass on to a natural cure by the bowel freeing itself, and in some acute cases the invaginated portion sloughs away, and a cure results. In well-marked chronic cases, however, when the diagnosis is complete, and there is a reasonable prospect of the individual surviving the shock of such an operation, "laparotomy" should be performed, Hutchinson's and Howse's cases being certainly encouraging.

Operation justified.

Operation for intestinal obstruction.

The operation of "laparotomy," a good term suggested by Dr. John Ashurst, jun. ('American Journ. of Med. Science,' 1874) from λαπαρα the soft parts of the body below the ribs, and τεμνω I cut, is one upon the abdomen for the relief of an internal strangulation or intussusception, and it is an operation that I believe will become more common as time progresses. The term "gastrotomy" being applied to operations upon the stomach for the removal of foreign bodies, "gastrostomy" to an operation upon the stomach with a view of establishing a permanent fistula, "colotomy" to those upon the large intestine, and "enterotomy" to those upon the small. In laparotomy the abdomen should be opened near the seat of pain. If an old hernia exists the sac should be explored, and the abdominal incision made upwards from its neck; where no such indication exists, the opening may be made in one or other of the lineæ semilunares, as suggested by the symptoms, and all vessels secured as divided. The abdomen should at first be explored by the finger, and more particularly towards the umbilicus, for it seems that bands are more often found opposite the promontory of the sacrum than anywhere else. Should the finger fail to find out the cause, the opening must be enlarged and the parts inspected, and, when possible, the cause of the symptoms should be removed, in intussusception the bowel being freed. The wound should be carefully adjusted by stitches. After the operation the patient should be kept under the influence of opium or morphia, the morphia suppository every five hours being the best form to use. Milk diet should be given in small quantities, and, if recovery is to follow, it will probably be speedy; for repair takes place rapidly in all abdominal sections when a case goes on well, and death ensues speedily when the reverse occurs.

On Tapping the Intestine.

On tapping the intestine.
Arguments in favour.

The practice of tapping the intestine with a fine trocar and canula, in cases of intestinal obstruction, is one which deserves serious consideration, for there is good reason to believe that a small puncture may be made into a distended intestine, and wind drawn off without any extravasation of the contents of the bowel taking place; and that if the distension of the strangulated, twisted, or otherwise obstructed bowel, can be relieved by the operation, there is good ground for hope that natural efforts may then release the bowel from beneath its band, or from some internal peritoneal ring, and that even a twisted bowel may untwist. I have been led to think, also, that even in a large hernia its strangulation might be relieved by a like operation and a natural reduction take place; for a strangulated bowel, outside as well as inside the abdominal cavity, is strangulated by the distension of the intestine itself, more than from any extra-intestinal influence, and if this distension can be relieved by simply drawing off the contents of the bowel by means of a very fine trocar and canula, the walls of the intestine would collapse, strangulation would cease, and unless adhesions confined the bowel in its position, its return might be looked for by natural efforts. These remarks are based upon the fact that intestine may be so treated without any extravasation following, and this fact came before me in a case of ileo-colic scrotal hernia, in a gentleman, æt. 76, in which, to enable me to reduce the bowel, I was driven to puncture the protruding intestine in four or five places, and although much manipulation followed this practice, no extravasation occurred at the time or after, for a rapid recovery took place without a drop of suppuration. The case was one which occurred in the practice of Mr. Kelson Wright, of Kennington. These remarks are only to be read as suggestions, and more particularly as applied to large umbilical and scrotal herniæ. Since the introduction of the pneumatic aspirator by Dr. Dieulafoy this practice has received much encouragement. For more detailed evidence upon this subject of intestinal obstruction and its treatment, the following papers may be referred to:

Case in which it was performed.

Brinton, 'Croonian Lectures,' 1859.—Fagge, 'Guy's Reports,' 1868.—Guy, 'Trans. Lond. Med. Soc.,' 1861-2.—Gorham, 'Guy's Reports,' vol. iii, series 1.—Hinton, 'Association Med. Journal,' 1853.—Smith, 'American Journal of Med. Science,' 1862.—Bryant, 'Med. Times,' 1872.—'A Treatise on the Pneumatic Aspiration of Morbid Fluids,' by Dr. George Dieulafoy, 1873.

On Tapping the Abdomen.

Paracentesis of abdomen.

Whenever fluid so collects in the abdominal cavity as to interfere with life's functions, the operation of tapping may be called for. It may be for *ascites*, a collection of fluid in the peritoneal cavity; for *ovarian dropsy*, a collection of fluid in a single or in a polycystic tumour; or for *hydatid*, whether hepatic, pelvic, or peritoneal. It may also be called for in *renal* or *splenic* cysts.

It would be out of my province to enter minutely into the diagnosis of all these conditions, for the majority of such cases come under the care of the Physician, the Surgeon being called in simply to operate. Nevertheless, it will be as well to give some of the leading points of diagnosis, for I need hardly say that the operating Surgeon is not relieved of all responsibility of diagnosis by the fact that a medical mind has charge of the case; he is to be the operator, and as such assumes part, at least, of the responsibility of the case as well as of the operation.

Diagnosis previous to tapping.

Ascites.

Diagnosis.—In a general way it may, therefore, be asserted that *ascites* is the result of a chronic action that has been going on for some time, it may be from liver disease, peritoneal disease, heart disease, or renal disease, the abdominal dropsy being one of the results only. The history of the case will consequently be a great help in coming to a conclusion. The fluid will, moreover, be found to fill the abdominal cavity equally; fluctuation being perceptible across the abdomen, and from before backwards well into the loins, even when resonant. As a rule the intestines will be found floating upwards, thus giving resonance on percussion, the position of the bowels being influenced by that of the patient. With the body horizontal they will give resonance at the umbilicus; with the pelvis depressed, above this point; with the pelvis well raised, resonance may even be felt near the pubes. In almost all these cases the sound over the loins will be dull. On looking at the abdomen the surface will be smooth and the enlargement equal. The subject of diagnosis of ovarian uterine disease will receive attention in Chapter XXVII.

Diagnosis of hydatid tumours.

Hydatid tumours, however large, rarely produce other symptoms than those mechanically caused by their size. Their origin is indicated by their position, although when situated in the pelvis there may be an impossibility in diagnosing them from ovarian cysts. They are almost always very globular and tense. They rarely give rise to distinct fluctuation. The external feel of a hydatid is somewhat peculiar and characteristic. In 1868 I removed, with permanent success, an enormous hydatid tumour from the abdomen, although apparently not from its cavity, of a lady patient of Dr. Oldham, æt. 35, who was believed to have had ovarian disease ('Guy's Hosp. Rep.,' 1868), and Mr. Spencer Wells has recorded a case in which the hydatids were turned out of the abdominal cavity. Under all circumstances the condition of the bladder should be inquired into.

Description of the operation of tapping.

The operation.

Instruments, &c.

The instruments required for the operation are a moderate-sized trocar and canula; an india-rubber tube about six feet long, adapted to a silver tubular plug that fits the canula when the trocar is removed; a lancet or small scalpel; a pad of lint; and a roll of good strapping.

Some Surgeons prefer one of the modern instruments, by which the india-rubber tube is attached to the canula at right angles, and they are very good; but the instruments I have named are ample.

Position of patient.

The patient should be brought to the edge of the bed and placed in the recumbent position, with the shoulders raised; a folded sheet or piece of mackintosh cloth having been previously so arranged as to protect the sheets. With the trocar and canula warmed and oiled, and a pail at hand, into which the end of the india-rubber tube is allowed to hang, the Surgeon may then with a lancet make a small incision through the skin and soft parts, about three inches below the umbilicus, or at any other spot at which the operation is to be performed; he should then introduce the trocar and canula with a direct force and semi-rotatory movement of the wrist, guarding, with his forefinger fixed about one inch from the end of the canula, against inserting the trocar too far. The abdomen having been punctured, the trocar may be removed with the right hand, the canula being pushed further in at the same moment with the thumb, and its orifice plugged at once with the left thumb, to prevent the escape of fluid. The silver plug of the

Details of operation.

india-rubber tube may then be introduced and the fluid allowed to escape, the distal end of the tube being kept submerged in the fluid in the receptacle; the tube acting as a syphon.

To facilitate the flow and to evacuate the whole contents of the cavity some Surgeons roll the patient over on the side, or place him so at the first; but such a proceeding is not necessary.

Mode of finishing the operation.

When the fluid has ceased to flow, the canula is to be gently removed, the thumb and finger of the left hand nipping up the soft parts as its end appears, so as so prevent the admission of air into the abdominal cavity, and the trickling of any fluid down the patient. The edges of the wound may then be adapted by a piece of good strapping, and a pad of lint applied when oozing appears, but not otherwise; two or three bands of strapping, three inches wide, should then be adjusted to the front of the abdomen from side to side. Where great hollowness is left, a pad of cotton wool often gives comfort. The old-fashioned flannel bandage may be abolished, it is only an inconvenience.

All pressure on the abdomen during the flow of the fluid should be avoided as being unnecessary, and also all pressure after the operation; support only is required.

Site of the operation.

The usual place to perform the operation is about two or three inches below the umbilicus in the linea alba; but in ovarian disease any point in the linea semilunaris may be used, and in rare cases any other.

Use of aspirator.

When a hydatid or other renal or splenic cyst requires to be tapped a small trocar and canula should be used, such as is employed for tapping a hydrocele; but in these cases the Pneumatic Aspirator is of great service, for by its use every drop of fluid can be removed without the possibility of any air being introduced.

Hydatid abdominal tumours.

Hydatid tumours of the liver, spleen, or other parts of the abdomen are occasionally met with, and from the mechanical inconvenience they cause, require treatment. Sometimes they die without surgical interference, and, as a consequence, severe suppuration is set up with violent constitutional disturbance, for which surgical aid is called for.

Treatment when suppurating.

Not long since I opened a large abscess over the liver of a boy æt. 17, and evacuated a quantity of pus, bearing the peculiar odour of hydatid pus, with marked benefit. The abscess clearly came from the liver, and was a suppurating hyatid. The boy previously had suffered from tape worms. In 1869, I had to open freely a suppurating hydatid tumour, which half filled the abdomen of a gentleman, æt. 40, who had had it tapped some months before in Australia, and a complete recovery ensued. A quantity of dead hydatid cysts escaped through a large canula that was introduced. The cyst was washed out daily with great benefit. This gentleman is now quite well. I have had three or four other cases in which a like treatment was employed with success. I have not lost one, although several have had a very narrow escape. The secret, I take it, of the treatment of suppurating hydatid cysts consists in a free outlet for all purulent and dead hydatid deposits, and the frequent washing out of the suppurating cavity with water containing iodine, Condy's fluid, carbolic acid, or creosote, with or without the introduction of a drainage tube or elastic catheter.

For the operation, a large trocar and canula should be employed, the canula being left in for some days until a good opening is established;

it may then be removed for an elastic catheter or large drainage tube.

Before suppuration.

Before suppuration, however, takes place other treatment is applicable, such as simply draining off the fluid contents of the hydatid by means of a very fine trocar and canula. I have done this on four occasions, and in each a permanent cure followed. At times, however, this operation kills the hydatid, and is followed by suppuration. My colleagues, Dr. Fagge and Mr. Durham, have given us good evidence that a cure may be obtained by electrolytic treatment, on Dr. Althaus's plan of introducing into the tumour two electrolytic needles, one or two inches apart, connected by means of wire to the negative pole of a galvanic battery of ten cells, and completing the current through the tumour by means of a moistened sponge, attached to the positive pole of the battery, applied to different points over the swelling, for ten or more minutes at a time. (' Med.-Chir. Trans.,' vol. liv.) This operation may be repeated according to circumstances.

This plan of treatment is one which should certainly be employed when simple tapping fails to cure.

For further information refer to Murchison's work on the liver, 1868, and Harley's paper, ' Med.-Chir. Trans.,' vol. xlix.

CHAPTER XV.

HERNIA.

Diagrams illustrating the different forms of Hernia, with some of its complications.

In all the thick black line represents the parietes covering in the hernial sac; the thin line the peritoneum and hernial sac; the small body at the bottom of the sac the testicle.

FIG. 229.—This diagram illustrates the tubular vaginal process of peritoneum open down to the testicle, into which a hernia may descend; when the descent occurs at birth it is called "congenital;" when at a later period of life the "congenital form" of hernia, Birkett's "hernia into the vaginal process of peritoneum," or Malgaigne's "hernia of infancy."

FIG. 229.

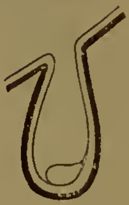


FIG. 229A.—The same process of peritoneum open half way down the cord, into which a hernia may descend at birth or at a later period. Birkett's "hernia into the funicular portion of the vaginal process of the peritoneum."

FIG. 229A.

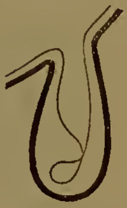


FIG. 229B.—The same process undergoing natural contraction above the testicle, explaining the hour-glass contraction met with in the congenital form of scrotal hernia as well as in hydrocele.

FIG. 229B.

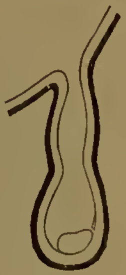


FIG. 229C.—Diagram showing the formation of the "acquired congenital form of hernia," the "encysted of Sir A. Cooper," "the infantile of Hey," the acquired hernial sac being pushed into the open tunica vaginalis which encloses it.

FIG. 229C.

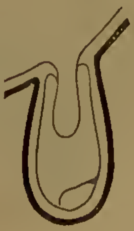


FIG. 229D.

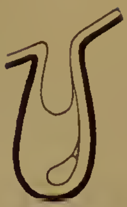


FIG. 229D.—Diagram illustrating the formation of the "acquired" hernial sac distinct from the testicle or vaginal process of peritoneum which has closed.

FIG. 229E.

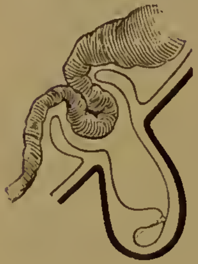


FIG. 229E.—Illustrates the neck of the hernial sac pushed back beneath the abdominal parietes with the strangulated bowel.

FIG. 229F.

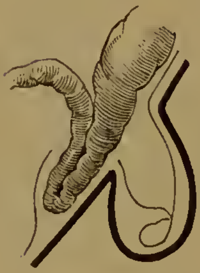


FIG. 229F.—Shows the space in the subperitoneal connective tissue into which intestine may be pushed through a rupture in the neck of the hernial sac; the intestine being still strangulated by the neck.

FIG. 229G.

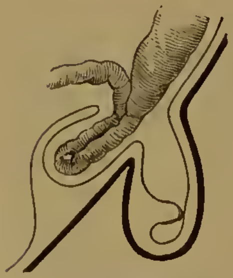


FIG. 229G.—Diagram showing how the neck of the vaginal process may be so stretched into a sac placed between the tissues of the abdominal walls either upwards or downwards between the skin and muscles—muscles themselves or between the muscles and the internal abdominal fascia—forming the intra-parietal, intermuscular, or interstitial sac; hernia *en bissac* of the French; "additional sac" of Birkett.

FIG. 229H.

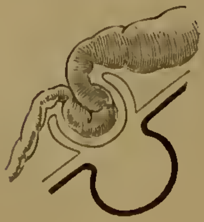


FIG. 229H.—Diagram illustrating the reduction of the sac of a femoral hernia *en masse* with the strangulated intestine.

ABDOMINAL HERNIA.

Abdominal hernia or rupture signifies the protrusion of any viscus from the abdominal cavity; and this protrusion for the most part occurs at the *inguinal* and *femoral* canals or *umbilicus;* occasionally, however, at other parts when the abdominal walls have been weakened by some inflammatory lesion, rupture, or division of muscle from injury or operation, and more rarely at such weak points of the abdominal walls as the obturator foramen, the perineum, the ischiatic notch or the vagina. On hernia. Situation.

It is met with in subjects of every social condition, but most frequently amongst the so-called working classes; and probably as Mr. Kingdon tells us in his excellent paper on hernia ('Med.-Chir. Trans.,' 1864) because "hernia occurs oftenest in the most numerous classes, and not in the most laborious." Class of society.

Hereditary predisposition to hernia is also doubtless a reality; a third of all cases acknowledging a history of having a ruptured parent; and I have been called upon to operate on an old gentleman, the male branches of whose family for four generations—twelve in all—have been ruptured, this predisposition probably existing as a general laxity of the mesenteric folds and parietal layer of peritoneum, and in inguinal hernia often as a failure in the natural closure of the sheath of peritoneum that travels down with the descending testicle, this failure being more common on the right side. Hereditary tendency.

Subjects who are congenitally feeble, and others who become so from illness or old age, are more prone to the appearance of a hernia than the robust, the weakness of the abdominal parietes yielding to the natural pressure of the abdominal contents under the influence of some sudden or prolonged muscular exertion. Although a large number of the cases of hernia are slow in their development, many are sudden, and in all, muscular exertion plays an important part.

Out of every 100 cases of hernia, 84 are *inguinal,* 10 *femoral,* and 5 *umbilical.* Hernia is more common in males than females, in the proportion of 4 to 1; 18,492 females only having been applicants for trusses at the Truss Society, out of the total of 96,886 ('Report,' 1861). Proportion as to its seat.

Females are as liable to inguinal hernia as they are to femoral, the inguinal being most common in early life, from the canal of Nuck being open; the femoral in middle and old age. In females under 20 years of age there are 87 cases of inguinal hernia to 13 of femoral; over 40 years of age there are 32 cases of inguinal to 68 of femoral, the largest number of femoral hernia being developed during the child-bearing period of a woman's life, between 20 and 40 years of age. Before menstruation it is so rare as to be almost unknown. Kingdon gives only four such cases. Hernia in females.

In males *inguinal* hernia is the usual form, Kingdon's table showing that the largest number of cases occur during the first ten years of life, in consequence of the vaginal process of peritoneum that covers the spermatic cord being still open; that between 10 and 20 years of age it is about half as frequent, between 20 and 40 it is as common as it is at the early period of life, and that after that period its frequency rapidly diminishes. Hernia in males.

Femoral hernia in the male occurs about four times in a hundred, but during the first ten years of life not more than once in 300; between the ages of 10 and 20, 2 per cent. are femoral; between 21 and 40, 4½ per cent.; between 41 and 60, 6 per cent.; above 60 nearly 8 per cent. Femoral hernia in the male as in the female becomes relatively more common than inguinal as age advances.

Average age when strangulated.

The average age of persons suffering from *strangulated inguinal* hernia is 43, from femoral 55. Of cases of "recent hernia" in which strangulation takes place on its first descent three fourths are femoral, and they are generally in subjects about 60 years of age. Recent cases of strangulated inguinal hernia are mostly in young adults, and of the "congenital kind." "Recent" cases of strangulated hernia are far more acute and fatal than those of long standing.

Recent hernia.

Anatomy of a hernia.

A *hernial tumour* is usually composed of a *sac* with its *contents*, and the soft parts covering it.

Acquired hernial sac.

Congenital hernial sac.

When the *sac* exists it is always made up of peritoneum; it is formed by the gradual stretching and pouching of this membrane through an opening in the abdominal parietes by the protruding viscera, and being thus artificial has been well named by Birkett the *acquired hernial sac.* This term is applied to distinguish it from a second form—equally well named—the *congenital hernial sac,* which is found only in inguinal hernia, and is composed of the vaginal tubular process of peritoneum formed by the descent of the testicle; the opening that normally exists in fœtal life not having closed from some deficiency in the obliterating process that naturally commences at the internal ring and proceeds downwards towards the testis in the descent of the organ into the scrotum.

The formation of the hernia in the former case is a gradual process, in the latter a rapid one, the "acquired" hernia being an affection of middle and old age, the "congenital form" one of infancy or young adult life.

The sac also is composed of a body and a neck, the neck communicating by a mouth with the abdominal cavity. When the hernia is small, the neck and body appear as a small pouch, and the hernial contents pass in and out with facility; the sac having no narrow neck by which the return of the intestine can be retarded; but when the hernial sac becomes large by escaping into looser tissues, and its body or fundus so expands as to render by comparison the neck of the sac a narrow canal or orifice, the return of the hernial contents often becomes one of difficulty, and under these circumstances its strangulation frequently occurs.

Changes in the neck of hernial sac.

The neck of the sac also undergoes changes which it is essential to understand. In a small hernia, as already stated, the neck and body appear as a small pouch; but in a large one, where a large extent of peritoneum has been forced outwards through the ring that surrounds the neck, the membrane thus drawn together naturally falls into folds and becomes more or less puckered.

Should this hernia and sac be reduced into the abdominal cavity, all these folds will disappear, and should the constricting ring of tissue external to it be divided, the same result will ensue, the amount of unfolding of the neck of the sac being regulated by the extent of expansion of which it is capable. But should the sac be neither returned nor its constricting outside ring of tissue divided, the puckered folds of peritoneum will adhere together, and the subperitoneal connective tissue will probably become connected with it; the neck of the sac, under these circumstances, instead of presenting a puckered aspect capable of becoming free, becoming indurated and thickened, in an old hernia, and particularly in an inguinal, and, having an independent existence, requires in operation special treatment.

This thickening, moreover, as time progresses, is followed by contraction, the neck of the sac consequently becoming narrower as it becomes less elastic, and adding another difficulty to the reduction of the hernial contents. This fact explaining why it generally happens that in old inguinal hernia, when an operation for strangulation is required, the sac has to be opened and its neck divided.

Absence of sac.

When a hernia forms at the seat of a wound in the abdominal cavity there is no sac, and the same occurs when the cæcum or colon protrudes through the inguinal canal.

Contents of hernia.

The *contents* of a hernia are usually small intestine and omentum, a portion of the last two feet of ileum being, as a rule, involved; the cæcum and colon are occasionally so, and cases are on record in which the bladder, stomach, or ovary has been found in the sac.

At times the omentum is so pushed before the intestine as to cover it completely, thus forming an inner sac; as a rule, the bowel is behind the omentum.

Varieties.

When intestine protrudes, the hernia is called an *enterocele;* when omentum, *epiplocele;* when both intestine and omentum occupy the sac, *entero-epipocele;* when bladder, *cystocele;* when stomach, *gastrocele*, &c. &c.

Soft parts covering hernial sac.

The tissues that cover in a hernial sac will necessarily depend upon the seat of the hernia. Thus, in the *umbilical*, it may be only skin and abdominal fascia; in the *scrotal* it will be the scrotal tissues; in the *femoral*, the skin with the superficial and deep fasciæ; but in all, and more particularly in the femoral, the Surgeon should bear in mind the anatomical fact, that a layer of fascia which lines the abdominal muscles and separates them from the peritoneum covers in the true peritoneal sac; it is known as the "fascia propria" of Sir A. Cooper, and between this fascia and sac some subperitoneal fat often exists.

Reducible, irreducible, and strangulated.

When a hernia comes down into a sac and goes up again, either by itself or aided by position or by the Surgeon, it is called *reducible;* when it cannot be returned, it is called *irreducible;* when it is constricted sufficiently to interfere with the return of the contents of the protruding viscera and the circulation of the part, it is said to be *strangulated.*

Bubonocele.

When the protrusion takes place *above* Poupart's ligament, through the internal ring, but does not traverse the canal sufficiently far to appear through the external ring, the hernia is called a *bubonocele* (*vide* right side of Fig. 230); when it does protrude through the external ring into the scrotum, it is called a *scrotal hernia* (*vide* left side of Fig. 230), both of these forms being included in the term *oblique inguinal hernia.*

Scrotal.

Direct inguinal.

When a hernia makes its way directly through the external ring without having passed down the inguinal canal, it is called a *direct inguinal* (Fig. 231).

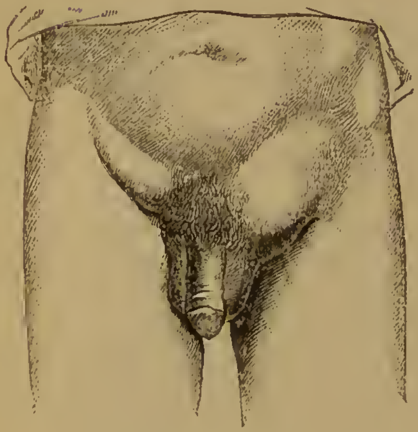
Femoral.

A *crural* or *femoral hernia* is *below* Poupart's ligament, the protrusion having come down through the crural ring on the inner side of the sheath of the femoral vessels (Fig. 232).

Umbilical.

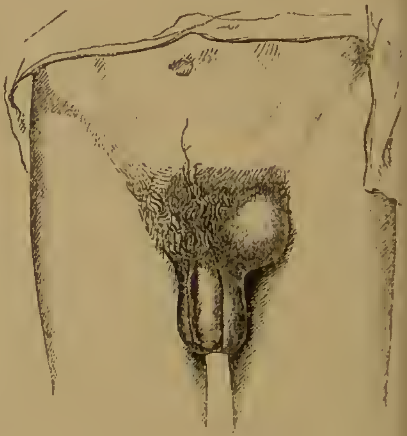
An *umbilical hernia* or exomphalos is a protrusion at the navel. A *ventral* is a protrusion at any other part of the abdomen. The names of every other form are according to the locality.

Fig. 230.



Oblique inguinal hernia.
Bubonocele on right side, but passing through external ring on left.

Fig. 231.



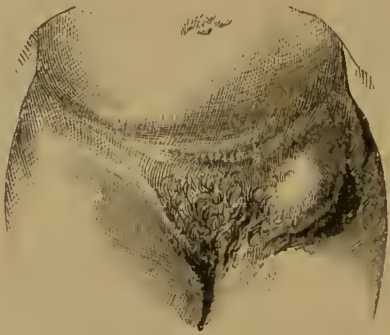
Direct inguinal hernia.

Symptoms of hernia.

Fulness at ring.

Symptoms.—A hernia in its early stage may show itself as a mere *fulness* about the internal inguinal, the crural ring, or other opening; this fulness becoming very manifest on the patient standing and coughing; the patient's attention has probably been drawn to the part by a feeling of *weakness* on taking exertion or in performing any natural act demanding the strong action of the abdominal muscles. With this weakness there is often associated some griping abdominal pain or feeling of uneasiness wrongly attributed to constipation, and in old people these symptoms should always attract the notice of the Surgeon.

Fig. 232.



Femoral hernia.

Tumour.

Impulse on coughing.

As the hernial pouch becomes larger the tumour increases in the inguinal canal, at the femoral ring or umbilicus, showing itself as a distinct swelling. This swelling is very clear when the patient stands or coughs, but it disappears on lying down, and is only prevented from returning, on the patient assuming the erect posture, by the finger being placed over the ring. The swelling always comes from above and travels downwards. As the tumour still further increases a distinct impulse will be felt by the hand when placed over it if the patient coughs, and a peculiar gurgling sound will be heard on the application of pressure to the part to cause its reduction. The return of the bowel also into the abdominal cavity will be marked by the disappearance with a jerk of the contents of the sac, and a distinct appreciation by the finger of the aperture through which it has passed.

Gurgling.

Capable of being replaced.

Diagnosis of contents.

"If the surface of the tumour be uniform, if it be elastic to the touch, if it become tense and enlarged when the patient is troubled with wind, holds his breath or coughs; if in the latter case it feels as if it were inflated, if the part return with a peculiar noise and pass through the opening at once, the contents of the swelling are *intestine.* If the tumour be compressible, if it feel flabby and uneven on the surface, if it be free from tension under the circumstances just enumerated, if it return without a noise and pass up gradually, the case may be considered an *epiplocele.* If a portion of the contents slip up quickly and with noise, leaving behind something which is less easily reduced, the case is probably an *entero-epiplocele.*" (Lawrence.)

Hernia of infants.

In infants where Malgaigne's "hernia of infants" exists (Fig. 229), or Haller's "hernia congenita," both being caused by the descent of intestine into the open vaginal process of the peritoneum, the tumour is very often large when first discovered and often scrotal. In young adults, where the same kind of hernia exists, the swelling comes suddenly and at once, by one rush downwards into the scrotum, this rush being accompanied with pain.

Treatment.

In all these forms of hernia, when reducible, either the *palliative* plan of treatment may be employed, or what is known as the *radical cure.*

Palliative use of truss.

The palliative treatment consists in the application of a *truss*—an instrument composed of a pad or cushion, connected with a metallic spring or with straps, and so arranged that the pressure of the pad keeps the hernia from descending; the spring maintaining the pad in position, and at the same time allowing perfect freedom of movement of the body. Any truss that does this is good; any truss that fails in this is worse than useless; it is injurious, as it gives false confidence.

The operation for the *radical cure* of hernia will be considered under the heading "Inguinal hernia."

Irreducible Hernia.

On irreducible hernia.

When the contents of a hernial tumour cannot be returned into the abdominal cavity an irreducible hernia is said to exist, and this condition may be brought about by anything that alters the relations between the bulk of the tumour and the neck of the sac, or opening through which they would have to return; it may be some excess of fæces or flatus in the part, or some fresh descent of omentum or bowel.

In older cases some development of fat in the omentum, adhesions between the sac itself and its contents, or the existence of bands traversing the sac may have the same result, as also when the intestine is caught between the folds of omentum.

The structures outside and within the neck of the sac have also an important influence in preventing the reduction of the tumour, such as their tonic or spasmodic contraction under the influence of irritation, and the induration of the neck of the sac itself or of the parts around.

When the cæcum or large intestine forms the contents of the hernia, the rupture may be irreducible, from the fact, that the peritoneum, which is naturally adherent to these parts and is dragged down with them, becomes fixed to the tissues into which it is protruded. A cæcal hernia is, however, always difficult of reduction. In one case I had to puncture the bowel with a trocar and canula, and draw off the air it contained before I succeeded. No harm followed this step, and the patient did well.

Prognosis.

An irreducible hernia is always a source of anxiety and danger, for when composed of omentum a piece of intestine may at any time slip down behind it, and become caught in one of its folds; and when composed of omentum and intestine, any accumulation of the contents of the bowel within the hernial sac may give rise to obstruction, and with this, strangulation of the hernia is not far off. An irreducible hernia, moreover, is always liable to injury.

May become large.

An irreducible scrotal, or even femoral, hernia will sometimes attain a large size. I have seen specimens of both reaching half way down the thigh. Umbilical hernia will sometimes attain a still larger size.

These forms of hernia often also give rise to dyspeptic symptoms—irregularity of bowels and colicky pains, but their chief danger is their tendency to become strangulated.

Treatment.
Bag-truss.

Treatment.—A large irreducible *entero-epiplocele* must be treated by a bag-truss; that is, with an instrument so adapted as to support the hernia, and prevent as far as possible its increase; a small irreducible hernia should be treated by a hollow truss. An *omental* hernia may be treated by a truss, the pad being made of such a shape as to adapt itself to the neck of the tumour, and of such a substance as to seal the orifice of the sac without causing pain; air, sand, or india rubber being probably the best material for pads. Every patient with such a hernia should be warned against taking violent exercise, or over-distending the abdominal viscera. The bowels should never be allowed to become constipated, and, above all, the slightest symptom of pain or increase of size in the tumour should be dealt with at once under medical advice; for these irreducible herniæ are treacherous things, and become obstructed and strangulated very insidiously.

Obstructed Hernia.

Obstructed hernia.
Symptoms.
Constitutional.
Local.

The *symptoms of an obstructed hernia* are not very definite, but the chief are obscure abdominal pains, with a dragging sensation about the umbilicus after food, nausea, and at times vomiting. Constipation, when present, always aggravates the symptoms, and renders the *local signs* of obstructed hernia more marked, the tumour under these circumstances becoming distended, tympanitic, and painful. On manipulation, however, the intestine in the hernia may be partially or wholly emptied of its gaseous if not of its solid contents, the compression of the tumour being accompanied by the peculiar gurgling sound of gas and fluid as these traverse the canal towards the abdominal cavity. An obstructed hernia, however, if unrelieved, may become inflamed. When these symptoms are chronic, they are generally known as indicating an *incarcerated hernia*, but such a

May become inflamed.

When chronic.

term is not satisfactory: it has been applied to different conditions, to the obstructed and the irreducible, and had better be discontinued.

Treatment.

Rest.

Warmth.

Treatment.—These cases require great care in their treatment, for if neglected, they pass on rapidly to inflammation or strangulation. *Rest* in the horizontal position is of primary importance, with some slight elevation of the tumour should it be scrotal. *Warmth* to the hernia, also, often gives comfort, relaxing the parts, and thus favouring reduction.

Use of purgatives.

Avoid manipulation.

When constipation exists, *unaccompanied by vomiting*, a brisk purge may be given, but with this symptom of obstruction a purgative enema should be preferred. By these means the natural action of the bowels is stimulated, and the contents of the hernial sac are moved on. The tumour itself, at this stage of the case, should not be manipulated. Such a step cannot but do harm, by bruising or setting up inflammatory action. Should success not attend these efforts, and the symptoms persist, the source of obstruction will have to be sought by the Surgeon—for it will probably be mechanical—and the case must be dealt with as one of strangulated hernia.

A reducible hernia may become irreducible.

Under certain circumstances, however, herniæ that *are ordinarily reducible become irreducible*, either from some fresh descent of bowel or omentum, or from some extra fulness of intestine from flatus or fæces, &c., when beyond abdominal and local uneasiness, no other symptoms may exist, although, if neglected, others will soon appear.

Use of ice.

Example.

In these cases reduction may be effected by rest in the horizontal posture, a brisk purge or enema, and the administration of small doses of saline purgatives, such as the sulphate of magnesia, so as to keep up a gentle action of the bowels, with the *local application of ice*, the diet being nutritious but not of a bulky nature. In this way I have procured in a boy, æt. 16, after a month's treatment, the reduction of a scrotal hernia that had been down three months; and in the case of a gentleman, æt. 36, after three weeks' treatment, in which, both locally and generally, much disturbance existed, a like success followed. Old irreducible herniæ are rarely made reducible by treatment, but the recent can generally be reduced by the means above indicated.

Inflammation of a Hernia.

An inflamed hernia.

Causes.

An inflamed is not a strangulated hernia. Inflammation of a hernia is generally the result of some injury to an irreducible hernia, whether from accident, a badly fitting truss, or ill-advised manipulation; an irreducible hernia after an attack of obstruction may also inflame; and a reducible hernia becoming temporarily irreducible may become permanently so from the same cause, adhesions forming within the sac between it and its contents.

Local signs.

The local *signs* of an inflamed hernia are pain, swelling, and induration of the tumour. In an omental hernia the tumour becomes nodulated and irregularly hard; and in an intestinal, much fluid collects in the sac. When the action is enough to interfere with the natural function of the tube, symptoms of general peritonitis or obstruction will soon appear. These must be dealt with on ordinary principles.

Treatment.

Treatment.—*Rest, purgatives* when obstruction in the hernia does not exist, and the *local application of ice* in a bag, are the most important remedies. By such means the symptoms are generally arrested, and when this result does not take place the case passes on to one of obstruction, if not of general peritonitis.

On peritonitis following obstruction.

General peritonitis is occasionally met with as a consequence of obstruction, from the adhesion of a piece of intestine to the hernial sac. I published such a case in 1861, in part iii of my 'Clinical Surgery,' and Mr. Birkett, in his excellent article in 'Holmes's Surgery,' vol. iv, 1870, has given a second case with a drawing which I also had the advantage of seeing, and he alludes to the fact that M. Littrè called the attention of the profession to the cases illustrated by the above in a paper "Sur une nouvelle espèce de Hernie," 'Mém. de l'Acad. Royale des Sciences,' 1700, p. 300. The notes of my case are as follows:

Example.

Umbilical hernia; obstruction to the bowels from a sacculated adherent colon; death.—A woman, æt. 56, having had a hernia for many years, was suddenly seized some twenty-four hours before her admission under the care of Mr. Cock, with symptoms of strangulation. The taxis, under the influence of chloroform, proved successful, but collapse and death followed in twelve hours. After death, general peritonitis was found to have been present; the intestinal coils being all adherent. An umbilical omental hernia, the size of a fist, existed, the omentum forming a distinct sac; to the centre of this the anterior wall of the transverse colon was firmly adherent, forming a kind of pouch. The colon was, however, tolerably free. The intestines above this point were distended, below it contracted and empty. The cæcum was of an enormous size, almost filling the lower part of the abdomen; it was here that the tension had been experienced; it was black, and in places the peritoneal coat was fissured, leading one to believe that but little extra distension could have been borne without a rupture taking place. The mucous membrane was also lacerated transversely, and the walls were so thin that they were nearly ruptured in handling.

In this interesting case, death had doubtless been caused by peritonitis; although not from the strangulation of the umbilical hernia, but from a partially ruptured and over-distended cæcum; a condition of bowel which had apparently been produced by the traction which had been exerted upon the transverse colon, the result of the adhesion of its walls to the omental sac.

Influence of adhesion of bowel to hernial sac.

As elucidating a secondary result of hernia this case must be regarded as a most valuable one; illustrating, as it does, a point not perhaps sufficiently recognised, namely, the influence of the adhesion of the bowel to a hernial sac or the abdominal walls upon the functions of the intestines; for doubtless such adhesions are sufficient to account for many of the griping and painful symptoms which exist in an old and irreducible hernia. The case just quoted must also be regarded as a good illustration of the result of a long-continued interference with the bowel's actions; for the over-distension of the cæcum, with its attendant consequences, was apparently entirely due to the interference with its functions, resulting from the union of the walls of the transverse colon with the omental sac. The calibre of the colon itself was not materially diminished, but its power of acting had become paralysed; the greater the distension of the intestine above, the greater must have been the traction caused by the adhesion, and as a sequel, the greater was the effect of this interference; at last complete paralysis of the part had taken place, and complete obstruc-

Over-distension of bowel paralysing its action.

tion, giving rise to all the symptoms and conditions which had terminated in death.

Slight traction of portion of bowel may cause obstruction.

I imagine it to be quite possible that the smallest traction of a portion of the calibre of the intestine in a hernia, or otherwise, although accompanied with an open passage of the bowel, is quite sufficient to interfere with the bowel's action, and even at last to cause complete obstruction.

Strangulated Hernia.

On strangulated hernia.

A rupture is said to be strangulated when its visceral contents are so constricted as to be irreducible, and the circulation of the fæces and blood of the parts is more or less completely arrested.

When occurring.

This may happen in its first descent, "*recent hernia*," but more commonly it takes place after a hernia has existed for many years, *old hernia*. An analysis of cases that I made in 1856 ('Guy's Reports') indicated that the average duration of an *inguinal* hernia previous to its becoming strangulated was twenty years, and that it was a rare occurrence for an inguinal hernia to become strangulated in its first descent; when this does occur the *hernia* (recent) is generally of the "congenital" and not the "acquired" kind.

The same analysis also proved that the average duration of a *femoral* hernia previous to its strangulation was eleven years, although femoral hernia was far more liable than inguinal to strangulation, and to strangulation on its first descent.

Recent hernia more serious.

"Recent" hernia, that is, hernia strangulated on its first descent, both of the inguinal and femoral forms, requires operation far more frequently than the "old" hernia, and is far more fatal.

It was also shown that *umbilical* hernia is far less liable to strangulation than either of the two other forms, that it is little liable to strangulation in its first descent, and that when strangulated it is almost always of very long standing.

Symptoms those of obstruction.

The symptoms of strangulated hernia are those of obstruction. In "*old inguinal hernia*" of many years' standing they are usually *chronic*; in "*recent hernia*" and more particularly of the femoral form they are *acute*.

General symptoms.

Thus it often happens that in a "recent" hernia, inguinal or femoral, its descent is accompanied by severe abdominal pain in the region of the umbilicus, vomiting and more or less collapse, vomiting first of the contents of the stomach, then of those of the duodenum, biliary vomiting, and at a later stage of the yellow contents of the small intestine and even of fæces. Constipation is usually present, although it is not uncommon for the large intestines to empty themselves on the first onset of the symptoms. With these general symptoms of obstruction the local signs of hernia will be present at one or other of the sites at which a hernia may occur, and the tumour will always under these circumstances be tense and painful, and no impulse will be felt in it on making the patient cough.

Local signs.

These symptoms are common to every form of obstruction whether outside the abdominal cavity from a hernia, or inside from internal strangulation, ileus, or any other cause; but in every case in which they occur the practitioner should carefully examine the site of every possible hernia, and not trust to the patient in any way, for the local are often masked by the severity of the general symptoms, and the local cause is apt to be overlooked.

Symptoms in old hernia.

The symptoms in an "old hernia" are less acute, but not less characteristic *when vomiting has set in;* but in all probability before this symptom appears the patient will have complained of some general abdominal uneasiness, such as flatulence, a feeling of faintness, nausea, and fulness, with local pain in the hernia; the nausea will, however, soon be followed by persistent eructations, hiccough, and vomiting; in most of the cases constipation will be present, but in some the desire to go to stool will be great and the straining severe. The local signs of strangulation or obstruction are often so slight as to be disregarded by the patient, and unless the hernia is discovered by the Surgeon, his attention will probably not be drawn to it by the sufferer. Thus at Christmas, 1870, I reduced by the taxis a femoral hernia, strangulated for one hundred hours in a man who was unconscious of its presence till a few hours before.

Progress of hernia when unrelieved.

If the obstruction remains unrelieved the powers of the patient will probably become prostrate and collapse more or less complete will show itself, with a feeble pulse and cold clammy skin. The vomiting also may diminish in intensity or even cease, at times remaining only as a passive pouring out of the intestinal contents through the mouth without an effort. Pain previously severe may also suddenly disappear. But this condition indicates as serious a collapse of the general power of the patient as it does probably a destruction of the parts strangulated in the hernia. The collapse, indeed, under these circumstances is sometimes so great that the parts about the neck of the sac become relaxed, and the hernia may go up either by itself, or by the gentlest pressure. But such a reduction is too often followed by a fatal collapse, death being under these circumstances usually the result of the shock to the nervous system from the severity or persistence of the symptoms. It may, however, occur from other causes, such as gangrene or death of the strangulated bowel, rupture of the bowel at the line of stricture, fæcal extravasation, or peritonitis.

Collapse.

Gangrene of bowel.

When gangrene of the bowel is the cause of death the collapse may be as great as it is from shock; but it is of greater duration. Death is slower.

Rupture of bowel.

When rupture of the bowel and fæcal extravasation are followed by collapse, they will have been preceded by symptoms of local or general peritonitis, or by a sudden severe abdominal pain; for in all cases of strangulated hernia in which any delay in reduction has taken place, symptoms of inflammation of the protruded parts, of local peritonitis, around the neck of the sac, and subsequently of general peritonitis, will be sure to show themselves.

Strangulated omental hernia.

Strangulated omental hernia is characterised by less severe and acute symptoms. They are the same in nature, but different in degree. The pain is less severe, the vomiting not so marked, constipation is less complete and insuperable; the constitutional symptoms are milder. The local distress is also inconsiderable, the tumour permitting manipulation more freely than when it contains intestine. It will also feel harder and more nodular, more like an obstructed hernia. As time progresses, however, symptoms of local inflammation in the hernial tumour will show themselves with those of local peritonitis, and when these appear they will be as severe as in any other form of strangulated hernia, and as destructive.

A strangulated omental hernia, consequently, requires as active surgical treatment as any other, for it leads to the same end—a fatal peritonitis.

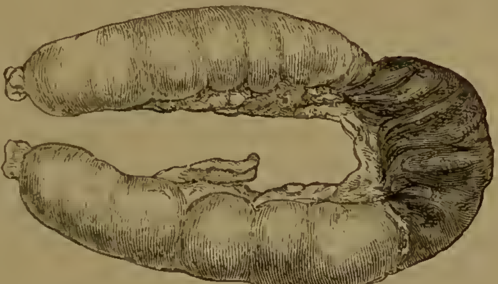
Pathological conditions of strangulated bowel.

Pathological changes, the result of strangulation.

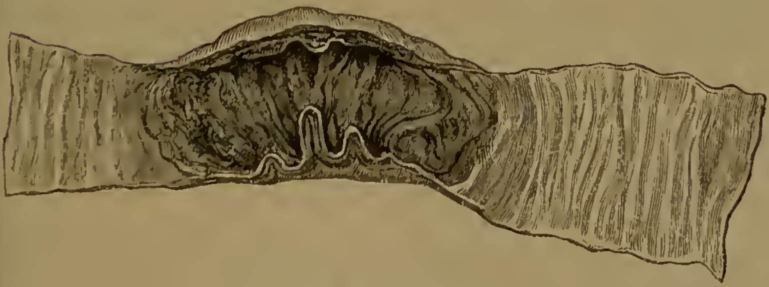
Serous effusion.

Accepting the definition of a strangulated hernia that has been given, the first effect of the *partial* arrest of the circulation through the parts is congestion, this congestion being accompanied by its usual consort, *serous effusion.* When *complete* arrest has taken place the congestion will be more thorough, and the surface of the bowel will appear of a red purple or blackish hue, the tissues themselves being thickened from effusion into their meshes, or blackened by extravasated blood, wholly or in spots (Fig. 233). When they have been much manipulated by the "taxis," the extravasation of blood into the tissues may be very marked. At this stage of the affection, the degree of this congestion will depend upon the intensity of the strangulation, and beyond a thickening of the tissues no other local change may take place.

Fig. 233.



Drawing 481^6. (Birkett.)



Drawing 481^6. (Birkett.)

Effects of severe strangulation of the bowel.

Extravasation of blood.

Inflammation.

When, however, the strangulation has been lasting, and an inflammatory action has been added to that of congestion, the bowel will be found not only swollen but soft, the natural glistening aspect and elasticity of its coats will have become changed for a dull appearance and leathery condition. The serous surface may indeed be covered with a layer or with flocculi of lymph, or the knuckle of intestine, wholly or in part, may be soft and gangrenous, ash-coloured spots, or even perforations, being visible on its surface.

Changes at neck of sac.

At the neck of the sac other changes will be found, which will materially depend upon the character and seat of the constricting force. When the line of strangulation is rigid and linear, as in direct inguinal and femoral hernia, the knuckle of bowel strangulated may be rapidly destroyed by gangrene, either as a whole or in part.

Ulceration of mucous membrane.

When the pressure is more diffused and less rapid, as in inguinal hernia, ulceration of the mucous membrane at the line of stricture, even to perforation, is more common, the grooved or sulcated condition of the serous surface in the line of stricture being found in both.

Peritonitis.

Within the abdomen every indication of peritonitis from the mere greasy condition of peritoneum to fibrinous or even suppurative effusion, may be met with. In most cases local peritonitis will be found about the seat of hernia, the strangulated portion almost always resting at the neck of the sac, if not adherent to it, with more or less matting together of the neighbouring coils. In some the peritonitis will be general.

That this peritonitis is to be directly attributed to the strangulation of the intestine is generally acknowledged, few cases of strangulated hernia remaining long unrelieved without local or general peritonitis making its appearance. It is also not to be disputed that this peritonitis is often aggravated, and at times caused by the reduction of the inflamed and injured contents of the hernial sac into the abdominal cavity; but to say with Mr. Hutchinson and M. Girard that in the bulk of cases it is the return of the intestine into the abdomen that gives rise to the peritonitis, is an assumption which the facts as hitherto known do not bear out.

Sloughing of bowel.

When the intestine has sloughed wholly or in part, and discharged itself through the wound, an artifical anus is said to exist; and this result is far more common after femoral than inguinal hernia.

When the bowel subsequently ulcerates after its reduction, either at the line of stricture, as in inguinal hernia, or at the centre of the knuckle, as in femoral hernia, extravasation of fæces may take place, half of these cases of extravasation being either general into the peritoneal cavity and fatal, or local about the neck of the sac.

The following facts, taken from a paper of my own ('Guy's Hosp. Rep.,' 1856), on the causes of death in hernia, will tend to prove these points. Out of 17 cases of artificial anus after hernia, 13 were femoral, 3 inguinal, and 1 umbilical. Out of 15 cases of gangrenous bowel, 11 were femoral, 4 inguinal. Thus, out of 32 cases of gangrenous bowel, 24 were femoral, 7 inguinal, and 1 umbilical, clearly proving that *gangrene of the intestine and artificial anus are more common after femoral than inguinal hernia.*

Statistics of artificial anus.

Out of 15 cases of hernia in which the strangulated bowel was found perforated, 10 were femoral and 5 inguinal; in 4 the perforation was at the line of stricture, all being inguinal; in 11 the perforation was in the centre of the knuckle, 10 of these being femoral. In 8 of these 15 cases extravasation of fæces was prevented by inflammatory exudation sealing the aperture. In 7 it existed, but in 5 only of these was it general; in the other 2 it was local. Of these 7 cases, in 2 the taxis was the direct cause, in 1 gangrene, both being cases of femoral hernia; in 4 ulceration at the line of stricture was the cause, all being inguinal.

From these facts it is evident " that ulceration in the line of stricture with fæcal extravasation is more frequent in inguinal than in femoral hernia, and that when it is found in the latter, it is generally from rupture of the bowel from forcible taxis."

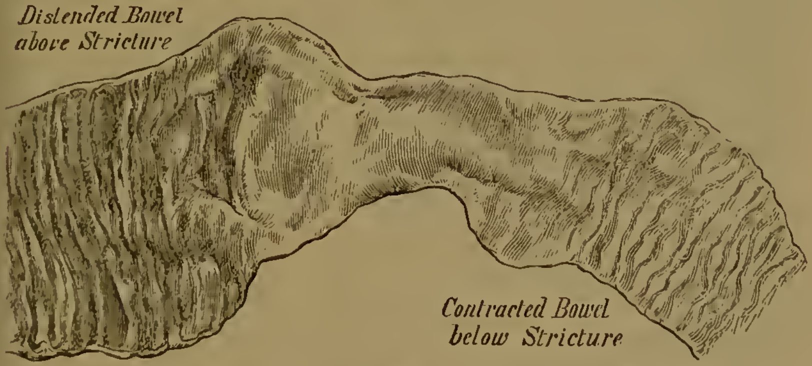
Stricture of intestine after strangulation.

As a result of a strangulated hernia, I must mention a stricture of the intestine due to a subsequent contraction of bowel that has been strangulated. An example of this took place in 1870 in my practice. A woman, æt. 52, upon whom I operated for strangulated femoral hernia, of thirty hours' duration, without opening the sac, did well after the operation till the seventh week, when vomiting appeared, and death took place in the eleventh week, from intestinal obstruction. After death a most complete stricture of a knuckle of bowel was found (Fig. 234).

Fluid in hernial sac.

The fluid found in the hernial sac varies according to the condition of the contents of the latter. In the early period of strangulation, when the contents of the hernia are merely arrested and the circulation impeded, simple serum will be found. When a more extreme congestion exists the serum will be more blood-stained. In still worse examples, where blood has been extravasated into the tissues, the fluid will contain blood elements or blood itself. When the hernial contents are inflamed, flakes or flocculi of lymph will be floating in the dark fluid. When the bowel is gangrenous, fœtor will be observed. When perforation has taken place fæces will be mixed with the fluid, and often gas. When the hernial tumour is red, infiltrated, and emphysematous, the Surgeon may safely infer that sphacelus of the gut exists.

FIG. 234.


Distended Bowel above Stricture
Contracted Bowel below Stricture

Stricture of the small intestine after strangulated hernia.

Thus, the condition of the fluid and the external aspect of the sac are valuable aids to diagnosis and prognosis in strangulated hernia.

Treatment of strangulated hernia.

Treatment of strangulated hernia.

When a hernia is strangulated, nothing but its immediate reduction is to be entertained. Delay is most deleterious. In the Surgeon it is criminal, for every hour of strangulation adds to the danger which it

Taxis.

is his duty to diminish. This is to be done by manipulation, or by what is technically called "the taxis," and should this fail, by "the operation" of herniotomy.

Chloroform.

To aid the Surgeon in the adoption of these means, the use of chloroform, or other anæsthetic, cannot be too highly praised, for it contains within itself all the advantages of every other form of treatment that has ever been employed, without a single disadvantage. It renders the reduction of a hernia by the taxis a gentle, and comparatively simple measure, and certainly a far more successful one than of old. It facilitates, also, the operation of herniotomy on the failure of the taxis. Indeed, the value of chloroform in strangulated hernia is so great that I would urge, where it can be rendered available, the taxis should never be employed without it, and that on the reduction of the hernia failing to be accomplished, "the operation" ought to be performed. The warm bath, the administration of opium, the injection of tobacco, the local application of ice, for strangulated hernia, are, in comparison, poor and unreliable remedies. They have had their day. To use them now, when we have at hand a far more valuable means at our disposal, is trifling with life. In *obstructed* hernia, and under certain exceptional circumstances, they are still of use, but in *strangulated* intestinal hernia, recent or old, inguinal, femoral, or umbilical, chloroform, the taxis, and operation, are the three great means of securing reduction upon which the Surgeon ought consecutively to rely. The taxis is not, however, equally successful in every form of strangulated hernia.

In *inguinal* cases two thirds, at least, are reduced by the taxis, a large proportion of these being successfully treated with the patient under the influence of chloroform, when the taxis without chloroform had failed. Strangulated old herniæ are more successfully treated by the taxis than recent cases, which are seldom reduced by this method.

In *femoral* hernia, on the contrary, the taxis is not half so successful as it is in inguinal, and it is far more fatal. It is most successful in "recent" cases; in old cases it seldom succeeds.

In *umbilical* hernia two thirds of the cases are reducible by the taxis.

Mode of applying taxis.

The taxis.—With the patient under the influence of an anæsthetic, and placed on the back, with the shoulders raised and the legs partially flexed and rotated inwards, in order to relax all the parts that can possibly affect the neck of the sac, the Surgeon should steadily grasp with the fingers and thumb of one hand the neck of the sac, in order to fix it, and at the same time prevent the contents of the sac—on being pressed—from bulging round the orifice. With the other hand the tumour, if large, is to be raised and gently compressed so as to empty it of its serous, gaseous, fæcal, or venous contents, and thus lessen its size. Having effected this a little continued pressure will, probably, be followed by the sudden rush backwards into the abdominal cavity of the hernial contents.

When this rush occurs the Surgeon may be certain that all is well; when the tumour has diminished in size, and its diminution has not been accompanied by the well-known sensation, a feeling of doubt should always remain in the mind as to the result, for the want of this symptom of healthy reduction, should suggest the possibility of a rupture of the bowel, or of a reduction into one or other of the unnatural pouches, which are now known to exist under certain circumstances at the neck of an inguinal hernia. To facilitate reduction a *gentle* kneading movement of the fingers at the neck of the sac may be made in inguinal hernia, as well as a steady traction downwards of the tumour, this traction rendering the neck of the sac a straighter channel for the hernial contents to pass through; with the same view the sac itself may at times be pinched up with the fingers of one hand and drawn downwards. Violence in manipulation under all circumstances is unjustifiable, and in proportion to the period of strangulation as indicated by the vomiting, is the danger increased. In femoral hernia also it is comparatively far more injurious than in inguinal, for not only may a bowel be ruptured by forcible taxis, an accident more common in femoral than inguinal hernia ('Guy's Rep.,' 1856), but it may be so bruised as to be irreparably injured. A preparation and drawing (Fig. 233) in the Guy's Museum show such extravasation of blood into the strangulated bowel of a femoral hernia as to cause its complete death, this extravasation having been clearly due to forcible taxis.

Gentle kneading at neck.

Force unjustifiable.

Where evidence exists that gangrene of the contents of the sac has taken place, or where, indeed, there is a suspicion of such a result, the taxis should not be used. In femoral hernia, recent or old, where fæcal vomiting has existed for some hours, the taxis is a dangerous practice, and in all old cases it is so unsuccessful that reduction by herniotomy is a more certain and a safer method. If there be hiccough, says Birkett, the taxis is inadmissible. The taxis may succeed without chloroform, but as a rule with the patient under chloroform a hernia that is capable of being reduced by the taxis goes up on the gentlest manipulation, and when this result does not take place force will not only not succeed, but must prove injurious.

Taxis inadmissible when bowel gangrenous.

When the taxis succeeds, vomiting usually disappears, although it may be kept up to a slight extent as an effect of the anæsthetic. The abdominal dragging pain will, however, at once be relieved. After the reduction of the hernia a pad should be carefully adjusted over the neck of the sac to guard against its re-descent, and when the patient has a cough the necessity of doing so is increased, for I have known the hernia descend, and a renewal of all the symptoms take place from a want of attention to this point; indeed it is a wise measure to adapt a pad till a truss has been obtained. The patient under all circumstances should be kept at rest for a few days after the reduction of a strangulated hernia. The diet should be nutritious but not solid, till the bowels have spontaneously acted, and no aperient under any but exceptional circumstances should be administered, for the bowels will to a certainty act as soon as the effects of the injury they have sustained by strangulation have passed away, and they have recovered their natural tone. Should, however, abdominal symptoms appear which can be attributed to a want of the natural action of the bowel an enema may be given, and repeated when required with advantage. Stimulants are to be used with caution. When the bowels have acted naturally the patient may be pronounced convalescent, and the ordinary diet, &c., may be allowed.

Treatment after reduction.

Avoid aperients.

Where chloroform is not at hand, and cannot readily be obtained, a good dose of opium, such as a grain and a half of the solid or thirty drops of the tincture for an adult, may be given and repeated, for when a patient with an old hernia is brought fully under the influence of this drug reduction may often be obtained by manipulation. In the

Opium.

very earliest hours of strangulation, before vomiting has become severe or passed beyond stomach vomiting, this practice is also at times successful; it may be tried also when the Surgeon cannot obtain the patient's consent to perform herniotomy, should reduction not be effected by the taxis under chloroform, or when time has necessarily to be lost in making arrangements for operative relief. Under the same circumstances a *hot bath* (99° F.) may be used. The local application of ice may be employed in *old* cases of hernia where the symptoms are chronic; and delay is a necessity or expedient; in omental hernia it is particularly valuable. It should be applied over the whole tumour in a loose bag. A purgative is never admissible with a strangulated hernia.

Hot bath.

Ice.

Taxis with inversion of the body.

The taxis with inversion of the body, with the legs flexed, pelvis raised, and shoulders depressed, has been successful in causing the reduction of a hernia. On a bed, it may be done by pillows placed below the pelvis. If one of Alderman's chairs or a lithotomy couch is at hand, it may be used.

Some Surgeons have, with a folded sheet placed round the abdomen, over the umbilicus, and the patient in the recumbent position, forcibly drawn the contents of the abdomen upwards.

Both these methods are founded on the principle of withdrawing by position and force the contents of the sac into the abdominal cavity.

They are possibly justifiable when herniotomy is not sanctioned, chloroform cannot be employed, and delay is dangerous. They cannot be strongly recommended.

Prolonged taxis to be avoided.

The taxis should never be employed for any lengthened period. With the patient under chloroform a femoral hernia of average size, that of a walnut, should never be manipulated for more than two minutes; half that time, or less, is usually sufficient to effect reduction where it is to be secured; any more prolonged effort will be injurious; the taxis should never be forcible. In large femoral herniæ, inguinal, or umbilical, five minutes may possibly be allowed; but the quarter and half hour's manipulation, that is too frequently talked about, is dangerous in the extreme. In very large herniæ ten minutes may be allowed without chloroform, and periods half as long again may possibly be called for. It is from this fact, coupled with another, that without chloroform twice the force is needed, that the use of the anæsthetic is to be recommended.

The reduction of a hernia by *gentle* taxis with a patient under chloroform is a simple, rapid, and successful operation. The reduction of a hernia by *forcible* or prolonged taxis without chloroform is a dangerous and far less successful proceeding. In femoral hernia, indeed, herniotomy had far better be employed. Under chloroform the taxis is almost always successful in inguinal hernia.

Operative measures.

When the taxis has failed, nothing but an immediate operation is justifiable. The operation is not of itself dangerous, although the condition that demands it is exceedingly so. It is not, and should not be, regarded as a last resource; in many cases it should be the first resource. When a patient is hanging, the first thing any one does is to cut the rope that is causing strangulation; no other means are admissible. When a piece of bowel is strangulated, the strangulating medium requires division to give it freedom; the doing of this adds nothing to the danger of the case. The danger lies in the strangulation, and this increases every minute.

Herniotomy.

Herniotomy or Kelotomy remains now to be described, and let it be repeated, *that it is to be performed directly the reduction of a strangulated hernia by the taxis has failed, and, if chloroform has been used, whilst the patient remains under its influence.* To submit a patient to the depressing effects of chloroform, to apply the taxis, and on its failing, to allow any period of time to pass before resorting to herniotomy is a practice to be condemned, a second administration of chloroform for the operation having no beneficial influence; it would be better for the patient and far better practice to delay the application of the taxis till chloroform can be obtained and the arrangements for operation made, on the taxis failing.

Objects of operation.

The objects of the operation are to liberate the strangulated hernial contents, and, in a general way, to return them into the abdominal cavity, exceptional cases occurring in which it is better practice to leave them in the sac, wholly or in part; and others, in which it is impossible to reduce them; but to these points attention will be drawn further on.

Division of stricture.

Its seat.

To liberate the strangulated hernial contents, the cause of the strangulation must be divided; and this, as previously shown, may be found in the tissues outside the sac, in the neck of the sac itself, or in the contents of the sac.

When the cause of constriction is found outside the sac, as is usual in femoral hernia, the opening of the sac is rarely needed, division outside being all that is required.

When the neck of the sac is the seat of obstruction and prevents reduction, an opening into it sufficient to allow of its division is all that is necessary. When the difficulty lies in the contents of the sac, the Surgeon will be required to lay the whole open, and expose it in order to remove it. But it is to be remembered, that the less the contents of a hernia are exposed and consequently manipulated, the better are the results; that when all that is desired can be secured by the division of the tissues outside the sac, there is no need of doing more; that when the division of the neck of the sac allows of the reduction of the hernia, a greater exposure of the contents of the sac is unnecessary and wrong, for in hernia as in all surgical interference, the Surgeon should carry out his objects in the simplest way his art will allow; he should never allow himself to do more than the absolute necessities of the case demand. Meddlesome surgery is always bad, but in hernia it is too often fatal.

When sac should be opened.

These remarks are, however, only entirely applicable to cases of strangulated hernia, in which the whole contents of the sac are reducible; for where *some portion remains behind*, a feeling of doubt may at times remain in the Surgeon's mind as to the thoroughness of the reduction of the strangulated portion, or the condition of what is left, and, under these circumstances, it is usually advisable that the sac should be opened and explored; but it is better to do so after the partial reduction of the hernia, when, in all probability, the strangulated bowel has been reduced, and is consequently out of harm's way, than with the whole contents of the sac *in situ*, when they may be exposed. When the *hernia cannot be reduced without opening the sac*, the whole must necessarily be explored. It will be thus seen that

Arguments on the opening and non-opening of the sac.

the question of opening or not opening the sac resolves itself into the necessities of the individual case. Where reduction can be effected without it, the "minor" operation is sufficient; where reduction cannot be effected by the "minor" the "major" operation must be performed.

The Surgeon who opens the sac in *every* case, clearly often does so unnecessarily. The Surgeon who opens it only when reduction cannot be effected without so doing, or when any uncertainty exists as to the condition of the parts remaining in the sac is free from such an error, "and although we dare not venture to say that some of the fatal cases which have occurred after opening the sac might have terminated differently had it not been incised, we do not hesitate to affirm, that the untoward circumstances stated as likely to happen when the sac is not opened, have not occurred" (Birkett), and both by my analysis of 126 fatal cases of hernia ('Guy's Rep.,' 1856) and by my experience since that date this view is confirmed. In the paper referred to I fairly showed that in no single fatal case could the opening of the sac have had the slightest influence in retarding or preventing the fatal result. The Surgeon who advocates the major operation in all cases still practises the taxis, and, I take it, is always well pleased to effect the reduction of a hernia by such means. The operation of herniotomy "external to the hernial sac" differs only from the taxis in the skin wound, and in what way the necessity for that wound renders the taxis an unsafe measure it is difficult to conceive.

It would be as reasonable to reject the administration of chloroform for the renewed application of the taxis in cases where the taxis had failed to reduce the hernia without its aid, as to say that because the taxis had failed, and a cutting operation is demanded, the ocular inspection and manipulation of the strangulated and therefore already injured bowel is required.

To argue that the liberation of a strangulated bowel is not complete until it has been carefully examined, and that without opening the sac, a hernia strangulated by omental or other adhesions or by the neck of the sac, may be reduced, are objections, which if applicable at all are as applicable against the taxis as any operation; they are indeed of little weight. The operation of herniotomy with opening the sac has been ably advocated by Petit who first adopted it in 1718, Munro in 1770, Key in 1833, Luke and others.

So far as statistics go, or are of value towards the solution of this point, they are in favour of not opening the sac. Thus out of 59 cases of strangulated femoral hernia operated upon at Guy's Hospital in eight years, in which the sac was *opened*, the mortality was 50 per cent., and out of 45 cases in which the sac was *not opened* it was only 30 per cent. The difference between the two classes of cases being 20 per cent. in favour of the minor operation.

Statistics in favour of not opening the sac.

Out of 35 cases of inguinal hernia in which the sac *was opened*, 60 per cent. died, and out of 9 in which the sac was not opened, 2, or only 22 per cent., died; the difference between the two classes in inguinal hernia being 40 per cent. in favour of *not opening*. But it must be remembered that as a rule the cases in which the sac was not opened, were of a more favourable kind than those in which it was opened.

In umbilical hernia, however, it is a rare thing to save a patient after opening the sac, and exposing its contents; when this is not done a good result may be looked for.

When sac should be laid open.

Whenever *the taxis is applicable* to a strangulated hernia and fails, herniotomy without opening the sac is applicable, and where reduction is effected nothing more is needed. Where reduction cannot be effected, or a doubtful piece of something remains in the sac, or the contents of the sac have not gone back with their normal rush, or the symptoms persist, or any doubt about the condition of the parts at the neck of the sac is raised, an exploration of the sac and its neck is absolutely necessary.

Whenever *the taxis is inapplicable,* that is, when the strangulation has been of so long a duration, the symptoms so severe, fæcal vomiting so persistent, and local as well as general symptoms indicate the probability that the strangulated gut has died or is dying, and whenever during the application of the taxis by the sudden collapse or yield of the tumour without its reduction, the fear is excited of some rupture of the bowel having taken place, herniotomy by the minor operation is inapplicable, the sac must be laid open and its contents dealt with.

Mode of performing the operation.

The operation itself.—The patient having been brought under the influence of chloroform, and placed with the shoulders slightly raised and the knees flexed upon a pillow, the integument over the seat of hernia should be shaved of all hair; an incision is then to be made over the neck of the sac; that is, in inguinal hernia, along the line of the inguinal canal, from the internal to below the external ring; in femoral, over or on the inner side of the crural ring, either in a vertical or oblique direction, in the course of Poupart's ligament, the former being the better. In this incision all the soft parts should be divided consecutively down to the sac, each layer of tissue being divided the full extent of the wound, while all vessels as they bleed should be twisted.

Sac to be exposed.

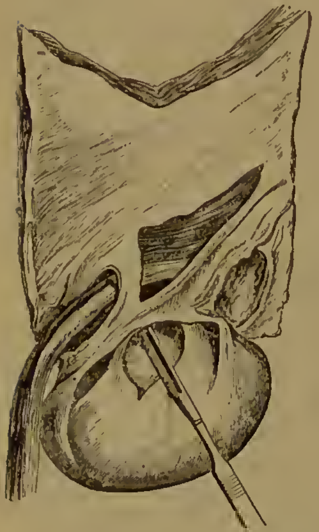
When the sac has been exposed, the seat of stricture outside its neck is to be felt for with the index finger, and when felt a director may be carefully passed beneath it, Aston Key's director, shown in Fig. 235, being by far the best.

Division of stricture outside sac.

With a hernia knife, such as that figured (Fig. 237), straight or curved, or herniotome (Fig. 237), the stricture is then to be divided, the incision *upwards* being the safest, to avoid the epigastric artery (Fig. 236). This division must not be too free—a quarter of an inch is generally ample in a small hernia—but it should only be just enough to allow of the return of the hernia without force. It is better to have to increase it than make it too large at first. The stricture having been divided outside the sac, reduction by the gentlest manipulation is to be attempted, and when the contents of the sac go up with a rush all the Surgeon needs has been effected. When no indications of reduction show themselves, or a portion of the contents of the sac has disappeared, but not with the characteristic jerk, or some piece has been left behind, the sac must be opened. To do this care is needed, the danger of carelessness consisting in wounding the bowel. To avoid this, the sac may be nipped between the thumb and finger, or seized with a pair of forceps, and slightly raised, a small opening being made into the raised portion with a scalpel applied laterally. Through this opening a director is to be passed, with its point kept close to the walls of the sac,

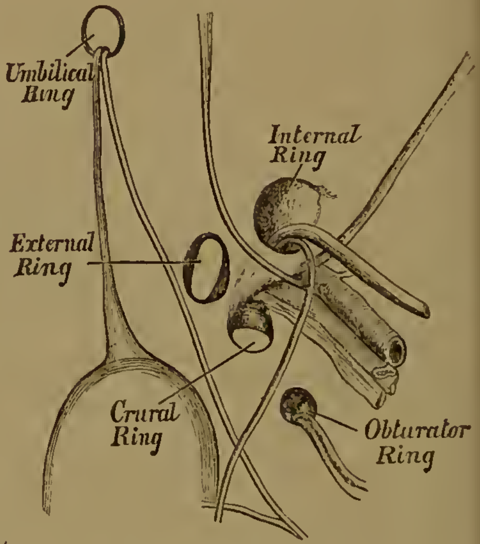
Sac to be opened on failure of reduction.

FIG. 235.



Key's director passed beneath the seat of stricture of a strangulated femoral hernia outside the sac, beneath the fascia propria. Taken from his work on 'Hernia.'

FIG. 236.



Drawing to illustrate the relative position of all the abdominal rings from within.

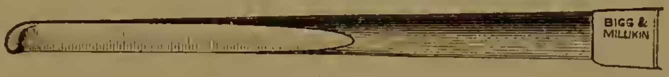
Examination of contents.

Care in dividing the neck.

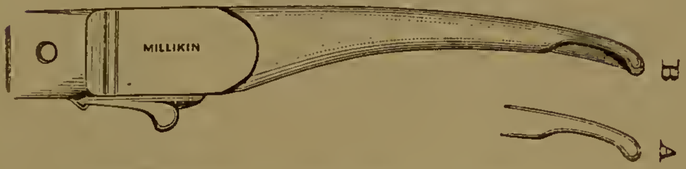
upwards towards the neck of the sac, and downwards towards the fundus, the sac being divided upon it with a bistoury. The escape of fluid usually indicates to the Surgeon the opening of the sac, and the character of the fluid the condition of its contents. But fluid does not always run away when the sac is opened, and at other times the escape of fluid from a cyst on the hernial tumour may mislead. The sac having been opened, its contents are to be examined, and in doing this the utmost gentleness must be employed. When a *knuckle of intestine* is present, and is neither grangrenous nor perforated, the abdominal cavity is its best place; it may be black from congestion and spotted from ecchymosis; it may be granular from lymph, or even covered with false membrane; but as long as it possesses its living resiliency, is not fœtid, flaccid, like wet wash-leather, ruptured or perforated, it should be returned. When a *large quantity of injured intestine* is found in the sac, it had better be left, the Surgeon simply relieving the constriction by the division of the cause of stricture. The neck of the sac is to be divided with the utmost care. The director, when employed, should be kept close to the walls of the sac, and guided by it towards its mouth. Its point should be carefully kept away from the bowel, and not introduced further into the abdominal cavity than to ensure the safe division of the stricture, and when the knife is passed along its groove the finger of the operator should carefully press the strangulated bowel away from it to protect it from injury.

When the director is not used the finger should be introduced to the neck of the sac, and the knife upon it, with its side pressed into the pulp of the soft parts. Both having reached the neck, the knife may be carefully turned upwards and the tissues divided, the point of the finger measuring the extent of the incision. When a herniotome, such as that figured (Fig. 237), is used, no director need be employed.

FIG. 237.



Hernia knife.



Herniotome director—A, Blade withdrawn; B, Blade exposed.

When intestine adherent.

When the *intestines are adherent* to the sac, or to one another, by filamentous or soft adhesions, these may be divided, but such are only met with in recent herniæ.

The fibrous adhesions of old herniæ had better be left alone, and the hernia looked upon as irreducible, the Surgeon being content, under these circumstances, with dividing the stricture, and thus relieving the strangulation, but not attempting its reduction. Should a fresh piece of bowel have come down this should be reduced, but the old hernia is to be left.

Care in handling bowel.

The strangulated intestine, under all circumstances, should be handled with extreme delicacy. *Any drawing down of its neck* to examine its condition is to be avoided. Such an act can do no good, but often does much harm, by tearing away adhesions that would have sealed an ulcerated orifice, prevented extravasation, and assisted repair.

Avoid useless exploration.

Any introduction of the finger into the abdominal cavity is also to be condemned, save under exceptional conditions. With the careful return of the bowel to the neck of the sac surgical interference ought to cease. The Surgeon may satisfy himself that such an end has been obtained without probing the abdominal cavity with his finger, and thus risking life by tearing away adhesions, and undoing in a moment what nature by her own processes had probably being doing from the first period of strangulation, to shut out from the general abdominal cavity what might prove injurious and dangerous to life.

When bowel is dead.

When the *bowel is dead,* as indicated by its flaccidity and ashy colour, all thought of its reduction must be put aside. The soft parts covering in the sac, with the sac itself, should be freely laid open, so as to expose the whole sloughing mass, *and the intestine left to nature,* to pass into what is called an "artificial anus." The neck of the sac may, however, be carefully divided, not, however, with the view of relieving the strangulation, for when the gut has become grangrenous, no strangulation exists to be relieved, but with a view of allowing the intestinal contents to pass outwards when an external opening takes place, and, should life be spared, for the subsequent retraction of the bowel towards the abdominal cavity, to effect a natural cure.

Free incision.

No free incision into the gangrenous bowel, no stitching of the intestine to the margin of the wound, is wanted, for fæces will soon find their own way through the opening that has been made by the artificial anus, and the Surgeon may be sure that within the abdomen sufficient repair has gone on to fix the intestine that had been strangulated to the neck of the sac, and thus prevent its immediate retraction; for it must be remembered that as time goes on this retracting process is the very one that nature adopts to procure a spontaneous cure of an artificial anus.

When bowel perforated or ulcerated.

When the *bowel is perforated by ulceration or ruptured,* and the opening is not a large one, the neck of the sac is to be incised as in an ordinary case, and the intestine that appears reparable replaced, the perforated or ruptured portion being left at the mouth of the sac. When the rupture or perforation is small, there is no objection to the Surgeon placing a ligature round the wound, and replacing the gut in the orifice of the sac, for plastic lymph will probably be poured out within a few hours, and the parts sealed from the abdominal cavity.

When bowel is in doubtful condition.

When *the bowel is in a doubtful condition,* and the Surgeon is not sure whether he can say it is irreparably dead, or going to die, the abdominal cavity is still its best place, when it can be returned. Aston Key advocated this plan years ago, and modern experience has not disproved its value. "The danger of abdominal extravasation will not be increased by replacing the injured bowel at the neck of the sac; for, should sloughing of its coats ensue, the slough may be walled in by adhesion of the surrounding peritoneum and fæcal extravasation be prevented." (Key, 'Guy's Rep.,' 1842.)

Causes of death in hernia.

In 1856, in an inquiry into the causes of death in hernia, founded on an analysis of 156 fatal cases, the same conclusion came forcibly before me. The weight of evidence led me, then, to express the opinion that there is only one condition of intestine in which its reduction to the neck of the sac is not advantageous, and that is when it is decidedly ruptured by gangrene or ulceration, my own materials tending to support the opinion of Mr. Aston Key, as stated to the writer, in 1849, "that in all conditions of the intestines the abdomen was their right place."

Mr. Hutchinson, who believes peritonitis to be the direct result of the reduction of an injured bowel into the abdominal cavity, advises in all cases that the damaged gut, if found in a bad condition, should be left in the sac; and Dr. Girard goes further, advising the contents of the hernia, under all circumstances, to be left, the Surgeon contenting himself by freely dividing the stricture. I by no means agree with this practice, nor with the principle on which it is based.

When the return cannot be pursued on account of adhesions, the neck of the sac should be incised, and the case left to nature. In large umbilical herniæ also this practice is a valuable one.

When omentum in sac.

When omentum is found in the sac with intestine, and has only *recently* descended, it may be returned. When it has been down for some time, is irreducible, and is only a small piece, it may be left alone; the omentum, doubtless, often acting as a plug to the orifice of the sac; when it is diseased or in large quantities, it should be ligatured in two or more portions and cut off, the ligatures being applied as near to the neck of the sac as possible, care being observed not to disturb the parts at the neck.

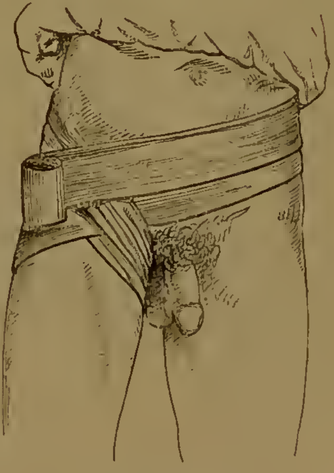
Risks in removing omentum.

Simply to cut off the omentum and tie or twist the vessels is risky, the omentum always being highly vascular, and small vessels being apt to bleed much; indeed, cases are on record in which a fatal hæmorrhage took place after this practice. When diseased omentum is left in the sac, prolonged suppuration often follows. Whenever intestine and omentum are found together in a hernia, much care is called for. The intestine is generally to be looked for behind the omentum, but it is often wrapped up in it, and, in not a few cases, it is covered by an omental sac. Under all these circumstances, the intestine is to be exposed and carefully reduced, care being taken that no adhesions at the neck of the sac, no bands, bind the bowel down to the omentum and keep up the strangulation. An omental sac is on no account to be returned into the abdomen unopened. Omental sacs are generally found in femoral hernia. An interesting paper by Mr. Prescott Hewett ('Med.-Chir. Trans.,' 1844) may be referred to on this subject.

Treatment after herniotomy.

After-treatment.—When a hernia has been returned into the abdominal cavity, the more the case is left to nature the better. As a matter of precaution after operation, as after its reduction by the taxis, when the wound has been brought together with strapping or suture, a pad may be adjusted over the part with a spica bandage (Fig. 238).

Fig. 238.



Spica bandage.

A suppository of half a grain of morphia or more should be at once introduced into the rectum, and repeated in an hour, should pain render it necessary; a little ice may be allowed for the patient to suck, when thirst is great, but the less that is taken by the mouth the better. When the powers are very feeble, brandy, soda-water, and ice may be given in small quantities.

Should no chloroform sickness complicate the case after the first twelve hours, beef tea, arrowroot, or milk, may be given, a pint or a pint and a half in the twenty-four hours being ample. Stimulants are to be allowed as the powers of the patient indicate, but always with caution.

Opium.

Avoid purgatives.

On the second day the wound should be dressed, water dressing being all that is usually required, the lower end of the wound being left open for the escape of discharge. Should pain continue, and symptoms of peritonitis appear, the opium or morphia suppositories may be repeated twice a day or more frequently; indeed, the patient should be kept under the gentle influence of opium till the symptoms are relieved; hot fomentations should be applied to the abdomen. Purgatives are never to be given if the bowel has been bruised or otherwise injured by its strangulation, for as soon as it has recovered its tone its natural action will return, any goading of it to action by medicine will do harm. "A bruised bowel," says Aston Key ('Guy's Rep.,' 1842), "is placed by nature in a state of rest; the exhaustion of the nervous energy of the part diminishes in the muscular tissue the disposition to contract. *Such inactivity of the bowel should be encouraged and not thwarted* by irritating purgatives. The Surgeon's anxiety to procure stools should yield to the evident necessity for time being allowed for the restoration of the natural powers of the injured bowel."

When enema to be used.

Three, five, ten, or even twenty days may be allowed to pass without any action of the bowels, without anxiety or without purgatives, as long as no other indications of mischief show themselves, but during this time liquid food alone is to be given with stimulants as needed. When some local distress is present, which the Surgeon can fairly attribute to the constipation, an enema of gruel and olive oil may be administered, and this may be repeated if necessary, such a simple intestinal stimulant being usually sufficient to induce the bowel to act should it have recovered its tone. When the bowels have acted naturally, convalescence may be declared and the usual diet allowed.

Any violent action of the bowels soon after the operation is to be watched with anxiety; in old people it is too often followed by a fatal collapse. Should it be too profuse it must be checked by opium. The patient should on no account be allowed to get up and walk until he has been fitted with a good truss.

Persistency of symptoms.

It occasionally happens that after the reduction of a hernia by operation the symptoms of strangulation persist, and the Surgeon is in doubt as to their cause. Under these circumstances the wound may at times have to be reopened, and the parts at the neck of the sac re-explored, for the case may be one of those of "displaced herniæ" to which attention is now to be drawn.

As a rule, however, the persistency of the symptoms is due to the obstruction caused by the injured bowel, or to the anæsthetic.

Should the bowel, however, not have gone up at the time of the operation with the usual rush, or should the Surgeon have any doubt in his mind as to its right reduction, the wound should be reopened, the utmost caution being observed by the Surgeon in examining the parts about the neck of the sac.

Multiple Herniæ.

Multiple herniæ.

When *two or more herniæ* exist with symptoms of strangulation, the one that on careful examination appears to be the most tender is to be first explored, and should this operation not give relief, the second must be treated in a like manner; indeed should no relief be given by the second operation and a third hernia exist, it should be explored, for it cannot be too often repeated that the operation is not one of danger, when compared with the necessity of the case that demands it. Dupuytren in his 'Leçons Orales' has recorded such a case. In the third part of my 'Clinical Surgery,' p. 204, I have likewise recorded another in which Mr. Cock was the operator. The patient was a man æt. 70, the left side was explored first, but as the symptoms continued the right was operated upon twelve hours later. Both herniæ were old inguinal, in both the sac was opened, and recovery took place.

Displaced Herniæ.

Displaced herniæ.

No cases demand closer attention then these; when understood and appreciated they may be successfully treated, when misunderstood they are sure to be overlooked. Thus it may be accepted as a fact that a strangulated hernia with its sac may be bodily reduced within the abdominal ring and behind the abdominal parietes, the intestine being still held by the neck of the sac (Fig. 229H). This form was first described by the French writers as "reduction en bloc," or "en masse," and by Mr. Luke in this country ('Med.-Chir. Trans.,' 1843). The majority of cases reputed to be of this nature are, however, probably caused by other lesions of the sac, and the credit of having made this out is due to Mr. Birkett, in an able paper read before the Med. Chir. Society, in 1859.

Causes leading to displaced hernia.

He describes three forms, but his observations apply only to inguinal hernia.

Varieties of displaced hernia.

It would thus appear that there are four varieties of displaced herniæ.

First form.

In the *first* the strangulated hernia with its sac may be bodily reduced within the abdominal ring and behind the abdominal parietes, but it is only to a femoral hernia that this accident can occur. It is the true "reduction en bloc," or "en masse," of the French writers and of Luke. Such cases are, however, rare. In November, 1871, I had this fact demonstrated to me in a case I was called to see by Mr. Berry of Pentonville. It was in a lady, æt. 64, who was said to have been ruptured for years, and had worn a truss. When I saw her she had been vomiting for a week, and a tense femoral hernia existed. Under chloroform I cut down upon the sac and divided the neck of the crural ring, and on attempting reduction of the sac's contents by gentle manipulation, to my surprise the sac with its contents suddenly disappeared into the abdomen. By a little abdominal pressure it was made to reappear, and it did so in the same sudden way, a second attempt at the taxis was followed by the same result, and renewed pressure upon the abdomen with a like reappearance. For the sake of fully satisfying myself and my medical friends of the nature of the case, I reduced the hernia *en masse* a third time, and then found some little difficulty in securing its reappearance. When I did so I took hold of the sac with my forceps, carefully opened it, and exposed the bowel without letting the sac go; I then divided its neck by a herniotome and reduced the bowel, keeping the sac well down. On the second day the bowels acted, but the patient subsequently died of a low form of peritonitis. In this case the whole process of reduction *en masse* was demonstrated most clearly before me, and it made me ask myself the question whether the same result might not have taken place had I attempted its reduction without operation by forcible taxis; for the facility with which the sac passed up within the crural ring was somewhat startling.

Example of reduction *en masse.*

My friend Mr. Henry Morris showed a specimen illustrating this fact at the Pathological Society. *Vide* 'Trans.' for 1871.

Second form.

In the *second* form the neck of the sac becomes detached by force from the internal abdominal ring, and pushed upwards beneath the abdominal walls, the intestine within the sac being strangulated by the orifice of the sac. This variety is illustrated by Diagram 229E, but still better in Figs. 239A and B, which I have copied from page 486 of the first vol. of the 'Medical Gazette,' published in 1828. The case formed the subject of a lecture by Sir Charles Bell, then Mr. Bell. It occurred in a man, æt. 47, who had been the subject of a right scrotal hernia for twenty years, which had come down and become strangulated three days before, but had been reduced, or rather *made to disappear;* the symptoms, however, continued and death followed. During the last twenty-four hours of the patient's life the hernia came down repeatedly during the day, and was each time reduced with great facility.

Sir C. Bell's case.

After death the hernia was found to be in the scrotum, strangulated and mortified (Fig. 239A); on applying pressure to it "the intestine could very easily and effectually be pushed through the external abdominal ring, so as to be hid from sight. On looking to the inside, however, it was seen that the portion of gut had carried the neck of the sac before it into the abdominal cavity B, Fig. 239B; and the duplicature of peritoneum which hung upon the inside of the neck of the sac being unfolded, had formed a new sac for the intestine in the inside of the abdominal muscles. Thus the fold of intestine was pushed through the external ring through the spermatic canal and through that part which is described to be an internal ring (but of which no trace could be seen), and was reduced within the the abdominal muscles, but not within the abdominal cavity," the neck of the sac still grasping the included portion of gut (B, Fig. 239B). The hernia was also clearly of the congenital form, although it had not descended as far as the testicle.

The two drawings (Figs. 239A, 239B) and descriptions are given as originally described by Sir C. Bell.

This case I have given somewhat fully as I believe it to be the

Fig. 239A.

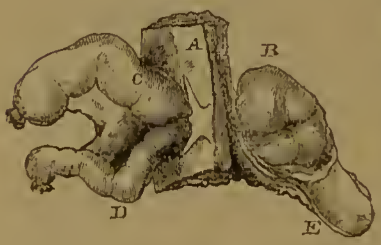


Fig. 239B.

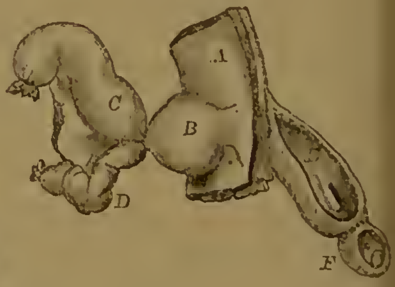


Fig. 239A.

A. A portion of the abdominal muscles, with the peritoneal lining.
B. The strangulated fold of intestine.
E. The testicle.

The dark lines at the neck of the sac represent the duplicature of the peritoneum, which being unfolded formed a sac for containing the intestine when reduced.

Fig. 239B.

A. Peritoneum lining the abdominal parietes.
B. The tumour formed when the strangulated intestine was pushed through the spermatic canal into the sac formed by peritoneum in the inside.
C. The superior portion of intestine.
D. The inferior.
E. The scrotal hernial sac.
F. The testicle, with the vaginal coat opened.

earliest on record in which this accident has been clearly described. In it the neck of the sac had evidently been pushed upwards within the internal ring with the strangulated bowel.

Third form.

In the *third* form (Fig. 229F), "as the effect of forcible and long sustained compression of the hernial tumour, the delicate serous membrane of the sac is rent, burst, or torn, and the hernia makes its escape through the aperture into the sub-serous connective tissue; its course outside the peritoneal sac is advanced by continued pressure; and detaching the connections of the neighbouring peritoneum, it forms for itself a pouch between that serous membrane and the internal abdominal fascia." —BIRKETT. The posterior part of the neck of an inguinal hernial sac is the usual seat of the rupture, and the position of the artificial sac is downwards and outwards. The "congenital" form of hernial sac is also the more prone to the accident.

Indications of a hernia having been displaced.

The indications of the accident having taken place are as follows: I give them in Birkett's words—"The tumour becomes flaccid, and, therefore, smaller; the bulk of the tumour slowly diminishes as the pressure is continued, until at last very little, if anything, can be felt, but the *Surgeon has failed to experience that sudden jerk so characteristic of the escape of the hernia* from the gripe of the mouth of the sac, as it enters the abdominal cavity. After the effects of the chloroform have passed away, *all the symptoms of strangulated bowel recur*, and, perhaps, with increased force. Even the tumour itself may reappear and recede on the application of slight pressure."

Mode of proceeding in such cases.

When this condition is found there is but one form of practice to follow, and that is the exploration of the sac; at its neck, two orifices will be found, one dipping down into the artificial sac, and the second into the abdominal cavity; from the latter the bowel will be seen to pass through the former into the artificial sac. The Surgeon must then draw out the bowel from the sac through its false orifice, and having freely divided the true neck or abdominal orifice of the sac, replace the intestine, and "the exercise of great care and caution is needed to prevent the entrance of the hernia once more into the abnormal space outside the peritoneal cavity."—BIRKETT.

Fourth form.

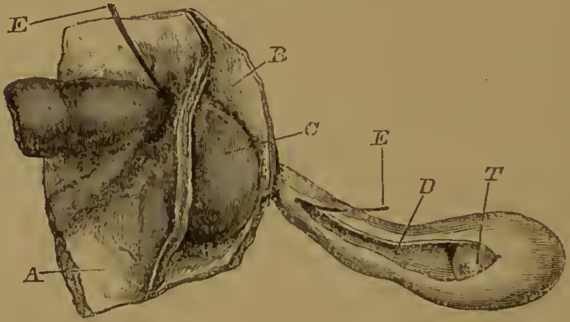
In the *fourth* form an intermuscular, interstitial, or *intra-parietal* sac, has also been described, being a kind of diverticulum from the inguinal sac; it is almost always found, according to Birkett, associated with the congenital form of hernia, and this sac may be found in the anterior abdominal walls, in an upward, outward, or inward direction, mostly behind the abdominal muscles in front of the abdominal fascia; in some instances in front of the external oblique muscle beneath the skin. Birkett refers to a case recorded by Scarpa, and a second by Dr. Fano. In some cases, the sac extends into the iliac fossa and rests upon the iliacus muscle, between the internal abdominal fascia and peritoneum; or directing itself inwards, it passes behind the horizontal ramus of the pubes, and reaches the side and front of the urinary bladder (Birkett). Diagram 229G illustrates this form of hernia, but Fig. 240 does so far more clearly.

Case.

It was taken from a preparation now in the Guy's Museum, which was removed from a man, æt. 36, upon whom I operated on September 23rd, 1869, for strangulated hernia. The man had been ruptured for fifteen years, and had worn a truss. The hernia had descended two days before his admission into Guy's, but the man had pushed it up by manipulation after a little trouble, but it did not go up as usual with a rush. After its reduction vomiting appeared and local pain, and in this condition he was admitted into the hospital.

When I saw him all the symptoms of strangulation were present. There was no hernia down, but there was some fulness at the internal ring, and above this towards the crest of the ilium a tense globular swelling was to be felt. This swelling I explored, and having laid open the inguinal canal I exposed the empty hernial sac (D, Fig. 240), with the testicle, showing that the hernia was of the congenital form. I then passed my finger into the internal ring and came against a knuckle of tense distended intestine. I enlarged the opening and this intestine at once protruded; it was of a dark colour but still glistening. In following up this intestine my finger passed downwards and outwards into a distinct cavity (C, Fig. 240), which was filled with bowel, but it was not the abdominal cavity. It was a distinct sac, with a smooth surface, and about the size of an egg. At its upper surface it communicated with the hernial sac, and above this with the abdominal cavity. I then increased the orifice leading into the abdominal cavity, drew out the strangulated bowel from the intra-parietal sac (C, Fig. 240) and returned it into the abdomen. The sac was clearly placed below the internal ring and between the abdominal muscles and peritoneum. The man died from peritonitis on the fourth day, his death allowing me to take the very pretty preparation from which Fig. 240 has been taken. The case was clearly one belonging to Mr. Birkett's third form or my fourth, an intra-parietal sac (Fig. 240, C) existing below the internal ring.

FIG. 240.



A. Peritoneum lining the abdominal muscles (B).
C. Intra-parietal sac with strangulated bowel.
D. Scrotal hernial sac leading down to testicle (T).
E. Director passed from the congenital scrotal sac through the internal ring.
In the drawing the strangulated bowel has been introduced to make the description clearer.

The disappearance of the tumour without the characteristic jerk and the persistence of the symptoms indicate all these forms. The treatment in all is the same as that described in the *third* form.

Prognosis of strangulated hernia.

Prognosis.—As the danger of a strangulated hernia depends upon the amount of damage the intestine has sustained by the strangulation, so the amount of damage the bowel has received is to be measured by the intensity of the strangulation and the period of its duration. A tight unyielding strangulation, such as usually exists in a femoral hernia, or in a direct inguinal hernia, does more harm in a short period, than a less tight and more yielding constricting force, such as is met with in oblique inguinal hernia, in a longer period; violent taxis adding materially to the danger of the case.

The existence of peritonitis before the reduction of the hernia is always an unfavorable sign, for it is not likely to be lessened by the introduction into the peritoneal cavity of a bowel already inflamed and altered in character. A hernia that has not been strangulated for many hours, that has not been injured by violent manipulation, and has been reduced by the "minor" operation in an otherwise healthy subject, will probably do well, when another that has been strangulated for days, or has been subjected to violent taxis, will probably do badly.

Where disease of the kidneys or of other viscera exists the prognosis is always unfavorable, and in old people the same opinion must be formed.

A case in which the intestine has been freely exposed is more unfavorable than one in which no exposure has taken place, and any excessive manipulation of the hernial contents always adds to the danger.

The reduction of a severely damaged intestine is more liable to be followed by a bad result than where little injury exists, but a slightly injured bowel in an aged or unhealthy subject is always likely to do badly.

A recent hernia requiring operation is always far more fatal than an "old case."

Early reduction important.

In private practice, where herniæ are, as a rule, discovered and treated early, good success follows herniotomy, but in hospital practice, where neglect and delay combined have had their influence, the success of treatment is very bad, about half dying. At Guy's Hospital the average period of strangulation for femoral hernia is seventy-six hours, of inguinal fifty; and half the cases that die after the operation do so within forty-eight hours, the injury to the bowel being so great and the power of the patient so reduced, that any reaction after the reduction of the hernia is rendered impossible, and under these circumstances the worst that can be said for the operation is that it fails to relieve.

Inguinal Hernia.

On inguinal hernia.

Inguinal hernia, or that form which protrudes through the internal or external abdominal rings, includes two thirds of all cases of hernia, and about half of all cases of strangulated hernia. Two out of three cases of strangulated inguinal hernia are reducible by the taxis; the third requiring operation. In hospital practice, half of those operated upon die; operations in recent cases are most fatal.

Oblique and direct distinctions.

An inguinal hernia is called *oblique* when it passes through the internal ring and the inguinal canal downwards towards the scrotum; *direct*, when it does not pass through the internal ring, but through the external in a direct way.

The oblique being also anatomically placed external to the internal epigastric artery, is called *external oblique*, and the direct from being internal to the same vessel is known as the *internal direct*.

When the oblique has not passed the external ring, it is known as a *bubonocele;* when the oblique or direct has passed into the scrotum, it is called a "*scrotal hernia*" or "*oscheocele*."

In the *oblique inguinal*, the sac of the hernia may be the natural "vaginal process of peritoneum" that was formed on the descent of the testicle in fœtal life, and has not closed, or the "*congenital sac*" (Figs. 229, 229A & B); or an *acquired sac* formed by the gradual pouching of the parietal peritoneum through the ring (Fig. 229D).

In the *direct inguinal*, the sac is always of the acquired form.

Anatomy of vaginal tubular process of peritoneum.

This "vaginal tubular process of peritoneum" that communicates above at the internal abdominal ring with the peritoneal cavity, and below is in close contact with and adherent to the testicle, lies in front of the spermatic cord, and before birth, or soon after, "it contracts near the head of the epididymis, its surfaces adhere firmly at that spot, and thus two cavities are formed." The inferior one forms the permanent covering to the testis, and is known as the tunica vaginalis propria testis. The superior canal, when no arrest of development takes place, subsequently contracts, this action commencing at the internal ring, till the canal ceases to exist.

Varieties in the closure of the tubular process.

When an arrest of development occurs, and the abdominal orifice of the tubular process remains patent, a piece of intestine may at any time descend. *When the whole length* of the canal is open, the hernia will pass down *at once* into the scrotum to the testicle masking its presence, and in this way the "*congenital hernia*" of Haller, the "*hernia of infancy*" of Malgaigne, or the "*hernia into the vaginal process of peritoneum*" of Birkett, is formed (Fig. 229).

When the closure of the canal takes place higher up—for such an event is possible at any point from the testicle upwards—the descent of the hernia will be limited, but its nature is the same, the only difference being, that in this condition the testicle will be found below the hernial sac at a variable distance, and separated from it. To this form of rupture Birkett has given the name of "*hernia into the funicular portion of the vaginal process of the peritoneum*" (Fig. 229A).

Congenital form of hernia in adult life.

It must also be mentioned, that it is not uncommon for this tubular vaginal process to close at its abdominal orifice at the internal ring, and yet remain more or less open as a cavity below; and, under these circumstances, any *sudden rupture or giving way* of the closing medium will be followed by the rapid formation of a hernia, the hernia being scrotal, wholly or in part, lying upon or separated from the testicle, according to the absence or position of any point of closure. This form of hernia differs only in the sudden giving way of the abdominal orifice of the vaginal process from those last described. It is very common in young adults.

Congenital form of hernia.

To all these forms of hernia in which the sac is composed of the natural tubular vaginal process of peritoneum, the term "*congenital form*" of hernia would probably be the best, as indicating their nature, distinguishing them from the other form rightly called the "*acquired*."

This congenital form of hernia is also frequently associated with some malposition of the testicle, its non-descent or partial descent.

Encysted hernia of tunica vaginalis.

The "*infantile hernia*" of Hey, or the "*encysted hernia of the tunica vaginalis*" of Sir A. Cooper, is an acquired hernia; the hernia *gradually pushing* the tissues closing the orifice of the vaginal process of peritoneum downwards into the open canal, the protruded parts together with the sac being contained in the tunica vaginalis testis, and the true sac being within that which might have been the congenital (Fig. 229c).

Hour-glass contraction of scrotal hernia.

The hour-glass contraction of a scrotal hernia is always found in the "congenital form." It is due, as described by Birkett, to the imperfect closure of the vaginal sheath at that part where union of its walls normally takes place, that is, above the testicles. Prep. 2368 in the Guy's Museum will explain these cases, likewise Fig. 229B.

The acquired form of inguinal hernia a slow act.

The acquired form of inguinal hernia, oblique or direct, is *always slow* in its formation, the pushing downward of the parietal layer of peritoneum by the protruding viscera being a gradual process, thus forming a marked contrast with the congenital form in all its varieties. In the oblique it begins as a slight yielding at the internal ring, and in the direct at the external, this yielding passing into a "pouching," till at last the pouch may reach and even fill the scrotum. In the early stage, this yielding may hardly be perceptible, but to the patient it will give rise to a feeling of weakness, and often of pain, on any abdominal muscular exertion being made. When a "pouching" has commenced, any act of coughing or straining will make it visible. Malgaigne has described this as a pointing of the hernia.

Bubonocele.

When the oblique hernia has filled the inguinal canal, it will appear as an ovoid swelling in the part *above* Poupart's ligament (*vide* Fig. 230), beneath the tendon of the external oblique muscle. When it has passed through the external ring, the long axis of the tumour, and more particularly its neck, will still be in the inguinal canal, and lie above and parallel with Poupart's ligament. It will, however, have escaped from beneath the external oblique muscle, and form a pyriform tumour of variable size. The testicle will always be found below and distinct from the sac, the cord being behind the tumour.

Direct inguinal.

In the *direct* inguinal form the pouching of the hernial sac is directly behind the external ring (Fig. 231); it has no inguinal neck, such as the oblique, but comes direct through the external ring down into the scrotum. It has a more globular shape than the oblique.

Oblique scrotal hernia.

When the *oblique* inguinal is reduced, the Surgeon can pass his finger through the external ring, along the inguinal canal, upwards and outwards into the internal ring, and thus into the abdominal cavity. In old herniæ the two rings are brought closer in apposition than natural. In *direct* inguinal, the finger having passed the external ring, seems to enter at once into the abdominal cavity, the opening being directly behind the external ring. It has no neck directed outwards and upwards, such as exists in the oblique form; with the finger passed through the neck, the external border of the rectus muscle may be felt, on the pubic bones. By these points the *diagnosis* between the acquired oblique and the direct inguinal is to be made out.

Difference between congenital and acquired forms of oblique inguinal.

A few words are, however, needed to mark the points of difference between the "congenital" and "acquired" form of the oblique inguinal, and in this, the history of its formation is the most important. When it has formed suddenly, and has passed at once into the scrotum, it is probably the "congenital form;" when it has been produced slowly, the "acquired." When it envelops the testicle, and renders its detection impossible or difficult, the "congenital form" is indicated.

When the testicle is in its right place and distinct from the hernial sac, the hernia is "acquired."

A hernia with a long tubular neck occupying the inguinal canal is probably of the "congenital" kind, a short thick neck being more common in the "acquired."

The congenital form is *the* hernia of infancy and young adult life, the "acquired" *the* hernia of middle and old age.

The youth of the patient, the rapidity of its formation, and its close connection with the testicle are the three chief points characteristic of the "congenital" form of hernia in all its varieties. The age of the patient, the slowness of its production, and its distinct separation from the testicle are the three points indicative of the "acquired" hernia.

Diagnosis of inguinal hernia.

The diagnosis of an inguinal hernia from other tumours is only difficult in exceptional cases. No scrotal tumour that begins from below in the scrotum or testicle and develops upwards can be hernia, for all herniæ descend towards the scrotum. Thus, when a distinct separation exists between the scrotal tumour and the external ring no difficulty ought to exist. In this way ordinary hydroceles, hæmatoceles, and all diseases of the testicle are excluded.

Hydrocele and its varieties.

When a *hydrocele,* however, passes upwards through the external and even to the internal ring—a condition by no means uncommon in infancy and young adult life—when the vaginal process of peritoneum is only closed at its abdominal orifice, some difficulty may be experienced; but the absence of all symptoms of hernia, the history of the case, that the swelling began below and travelled upwards, and its general translucency, will indicate the nature of the affection.

Congenital hydroceles into the vaginal process are to be distinguished from congenital hernia by their being transparent, by the gradual filling of the sac, and by their vibration on percussion. A hernia is opaque, it enters the sac rapidly, leaves it quickly, and does not vibrate.

An *encysted hydrocele* of the cord appears as a tense-fluctuating transparent tumour, and is irreducible; it ought not to be confused with a bubonocele when no general symptoms of hernia, beyond the swelling, exist.

Varicocele.

The wormy feel of a *varicocele* or varicose spermatic veins ought to prevent it being mistaken for a hernia; but the fact, that pressure over the external ring sufficient to keep any hernia in position with the patient erect, renders the varicose veins more marked, should prevent any error being committed.

Undescended testicle.

And if the Surgeon would only look for the two testicles in every case of scrotal, or even inguinal swelling, he would never fall into the error of mistaking an undescended testicle, or one resting at the internal ring or in the inguinal canal, for a hernia, or any other disease.

Hernia and hydrocele combined.

When a hernia and hydrocele coexist, some difficulty may be experienced in the diagnosis; but the symptoms of each affection being separate, the diagnosis can hardly be very difficult.

But whenever doubt in diagnosis is experienced, and symptoms of a strangulated hernia are present, with an inguinal tumour, the golden rule in surgery ought to be observed, and the doubtful tumour explored.

I had (Feb., 1872) with the Messrs. Toulmin, of Clapton, an interesting case, illustrating this, in a boy, æt. 4, who had an acute hydrocele associated with a sudden descent of a hernia into the vaginal process of the peritoneum of the cord. I tapped the hydrocele and left the inguinal tumour, thinking that it might possibly be a hydrocele of the cord, as no symptoms of strangulated bowel were present. As soon as such symptoms appeared, chloroform was given with a view of exploring the tumour, when, by the taxis, the hernia was happily reduced. The boy did well.

Inguinal hernia in female.

Inguinal hernia in the female child is very common; under puberty it is the usual kind. It is always of the "congenital form," the bowel coming down into the open canal of Nuck. It is found, however, at all periods of life; as a direct hernia, it is only seen in the adult. The rupture, at times, descends into the labium and may consist of the ovary. I have treated such a case. It is to be recognised by the same symptoms as are found in the male, and it is to be treated on the same principles. A hydrocele of the cord may be mistaken for a hernia.

Treatment of inguinal hernia. When reducible.

TREATMENT.—A reducible inguinal hernia is to be kept up with a truss, whether in the infant child or adult; the truss must also be *well fitting*. Sufficient pressure to keep the hernia in position is wanted, *but no more*. Should the hernia come down when the truss is on, it should be reduced, and the truss reapplied. The pressure of the pad in the oblique form should be over the *internal ring;* in the direct, over the *external*. In infants, a complete cure is often obtained by these means in a year or so, and should no descent show itself for another year, or any symptom of hernia, the truss may be left off; but in any case of hernia occurring after infancy, it is never safe to leave off the truss. In the congenital form of hernia, when some malposition of the testis complicates the case, the pad of the truss must not press the testicle. When the testicle and hernia are both in the inguinal canal, no truss can be tolerated. In all congenital herniæ the Surgeon should look to this, for many patients are caused severe pain by the neglect of this precaution.

When irreducible.

Irreducible, inflamed, obstructed and strangulated inguinal herniæ are to be treated on the principles already laid down.

When a hernia cannot be kept up with a truss, the question of the operation for the *radical cure* of the hernia may be entertained, but under no other circumstances, for the operation has its dangers, and Wutzer, its early advocate, admits, that a truss is necessary for life subsequently.

The Radical Cure of a Hernia.

On the radical cure of hernia.

This has been the aim of Surgeons from time immemorial; and were hernia only a mechanical lesion, its causes existing in the weakness of the walls through which it protrudes, and in the neck of the sac alone, some success would probably have attended the practice; but as a rupture is more probably due to the elongation of the mesenteric ligament of the intestine than to those already named, it can hardly be expected that any very good result should have been obtained. Gerdy, Wutzer, Rothmund, Wells, and Davies, have all tried to do this by plugging the mouth of the sac with its fundus, which has been invaginated for the purpose. Gerdy fixed the invaginated fundus by means of two sutures; Wutzer by means of a cylindrical wooden plug passed into the inguinal canal in the hollow of the invaginated structures up to its neck, a grooved wooden pad being applied externally over the first to hold the parts in position, the two being held together by a needle inclosed in the cylindrical part and made to pass through the internal ring and external tissues, and a screw, the plug being retained for six or seven days. Rotymund, Wells, Davies, and others, have only improved upon Wutzer's method. Mr. Birkett, however, tells us, on the authority of Dr. Otto Weber, of Bonn, the late clinical assistant to Wutzer, that Wutzer is still of opinion that his operation is not a dangerous one when properly performed, and that by his method the fundus of the invaginated sac may be made to adhere to its neck, and that in consequence of this, *if the patient continues to wear a truss for life a return of the hernia may be avoided.* Dr. O. Weber, however, writes, that he has never seen any of the so-called "cured cases" radically cured; that the plug of skin is by degrees entirely drawn out again; that the external and internal rings are not closed by the operation; that an imperfect cure may be effected by means of a partial closure by adhesion of the internal walls of the neck of the sac and thickening of the surrounding tissues. In London practice it is also well known that a fatal peritonitis has followed the attempt. With these facts before us respecting the so-called cure by invagination, and the knowledge that even when the cure has been effected the wearing of a truss is still an essential point of practice, the operation may be dismissed as one that cannot be recommended.

Weber's statement as to its inefficiency.

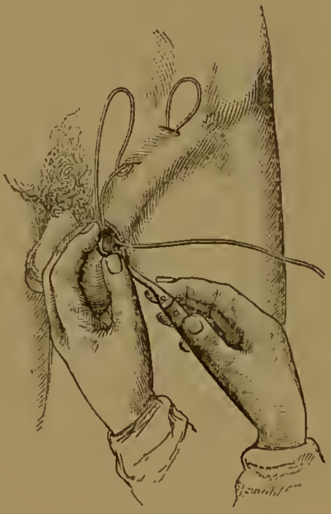
Mr. Wood, of King's College, believing that Wutzer's principle of practice was as wrong as his practice was unsuccessful, in 1863 devised an operation, by which the hernial sac, without the skin, is invaginated into the canal, and the hinder and inner walls of the inguinal canal are drawn forward by means of sutures, and fixed to the anterior and outer walls.

The steps of the operation are conducted as follows. They are taken from Druitt's 'Vade Mecum,' as revised by Wood:—

Mode of performing the radical cure.

The patient being laid on his back, with the shoulders well raised, and the knees bent, the pubes cleanly shaved, the rupture completely reduced, and chloroform administered, an oblique incision, about an inch long, is made in the skin of the scrotum over the fundus of the hernial sac. A small tenotomy knife is then carried flatwise under the margins of the incision, so as to separate the skin from the deeper coverings of the sac, to the extent of about an inch, or rather more, all round. The forefinger is then passed into the wound, and the detached fascia and fundus of the sac invaginated into the canal. The finger then feels for the lower border of the internal oblique muscle, lifting it forwards to the surface. By this means the outer edge of the conjoined tendon is felt to the inner side of the finger. A stout semicircular needle, mounted in a strong handle with a point flattened antero-posteriorly, and with an eye in its point, is then carried carefully up to the point of the finger along its inner side, and made to transfix the conjoined tendon, and also the inner pillar of the external ring. When the point is seen to raise the skin, the latter is drawn over towards the median line, and the needle made to pierce it as far outward as possible. A piece of stout copper wire, silvered, about two feet long, is then hooked into the eye of the needle, drawn back with it into the scrotum, and then detached. The finger is next placed behind the outer pillar of the ring, and made to raise that and Poupart's ligament as much as possible from the deeper structures. The needle is then passed along the outer side of the finger and pushed through Poupart's ligament, a little below the deep hernial opening (internal ring). The point is then directed through the same skin puncture before made, the other end of the wire hooked on to it, drawn back into the scrotal puncture, as before, and then detached. Next, the sac at the scrotal incision is pinched up between the finger and thumb, and the cord slipped back from it, as in taking up varicose veins. The needle is then passed across behind the sac entering and emerging at the opposite ends of the scrotal incision. (Fig. 241.) The end of the inner wire is again hooked on, and drawn back across the sac. Both ends of the wire are then drawn down until the loop is near the surface of the groin above, and are twisted together down into the incision, and cut off to a convenient length. Traction is then made upon the loop. This invaginates the sac and scrotal fascia well up into the hernial canal. The loop of wire is finally twisted down close into the upper puncture, and bent down to be joined to the two ends in a bow or arch, under which is placed a stout pad of lint. The whole is held steady by a spica bandage. (Fig. 238.) The wire is kept in from ten to fourteen days, or even longer, if the amount of consolidation is not satisfactory. Very little suppuration usually follows, but after a few days the parts can be felt thickened by adhesive deposit. The wire becomes loosened by ulceration in its track, until it can be untwisted and withdrawn *upwards*. In this operation the hernial canal is closed along its whole length, and an extended adherent surface is obtained to resist future protrusion.

Fig. 241.



From Wood.

Treatment after the operation.

After the operation, Wood says, a horse-shoe pad should be worn for a few months, *and when the patient is about to be subjected to violent strains or lifting, the truss is not to be thrown aside*. This is important to bear in mind; it tends, however, much to do away with the value of the operation.

Modifications of the operation are employed for infants, &c.

Wood's statistics of the operation.

The ingenuity of this operation is great, and *where the radical cure is called for* it should be employed. Wood says ('Lancet,' August, 1873) he has operated 200 times with three deaths, and out of 107 cases in which the results were more or less perfectly known, in 51 a return of the hernia took place, of which 42 returned within the year; in 56 a satisfactory result was secured. Thus, in the most favorable light there is one failure to one success, and a risk to life. It is to be feared, however, that a large number of these so-called satisfactory cures are only so when they leave the operator's hands, for Kingdon's

Reports of the City of London Truss Society tell us that within the last ten years fifty persons who had undergone some operation for the radical cure had, in consequence of its failure, applied for trusses; and this number is a large one, considering the Surgeons who perform this operation are not numerous, nor the cases abundant.

When the operation is uncalled for.

For my own part, I believe that where a hernia can be kept up by a truss, and the patient is likely to remain in a civilised country where trusses can be obtained, any operation for the radical cure is an unjustifiable one: to risk the life of a patient on the theory of a cure, when a truss has to be worn subsequent to the operation as a matter of safety, is both unfair and unsatisfactory.

When the operation may be justifiable.

When a hernia is reducible, and yet cannot be kept in place by a truss; when a patient is going abroad where trusses are not to be obtained, or only obtained at too great a cost, the operation for the radical cure may be performed. Under these circumstances I have undertaken Wood's and Wutzer's operation in some few cases with good success; that is, the patients who could not keep up their hernia previously on account of the great size of the inguinal ring were enabled to do so. Under all other circumstances I have refused to undertake it.

In the "congenital form" of inguinal hernia there seems a better prospect of success for the operation than in any other, and a better theory for the practice; for "thus allowing nature to guide our procedure, we must make it a rule to select those cases in which her efforts have failed; and by acting as her handmaid, we may reasonably hope to arrive at a successful result." (Birkett.)

The treatment of strangulated inguinal hernia and the operation have been already given.

Femoral Hernia.

On femoral hernia.

This forms about one tenth of the whole number of cases of hernia, and about forty per cent. of all cases of strangulated hernia. One out of three of the cases of strangulated femoral hernia is reducible by the taxis, two being operated upon, and of the cases operated upon 40 out of every 100 die, the operation after "recent" hernia being twice as fatal as that after the "old." Femoral hernia is far more liable than inguinal to become strangulated, and less likely to be reduced by the taxis. The taxis also is more prone to produce injury. A strangulated femoral hernia goes on more rapidly to destruction than any other, and a strangulated "recent" hernia than one of "old" date.

More liable to strangulation.

Anatomy of the hernia.

Femoral hernia descends from the abdominal cavity through the crural ring *beneath* Poupart's ligament, to the inner side of the femoral vessels. The free margin of Gimbernat's ligament bounds its inner side, as the sac, which is always an acquired one, and composed of peritoneum, pouches downwards beneath Poupart's ligament, and emerges through the saphenous opening to the inner side of the falciform process of the fascia lata; it expands laterally, and rests upon this fascia; as it enlarges it turns upwards over Poupart's ligament, and in the direction of the crest of the ilium, very rarely spreading downwards. Its long diameter will be transverse, and not vertical. The neck of the hernia will always lie *outside* the spine of the pubes, or the tendon of the long adductor, while an inguino-scrotal or labial hernia

Position of neck of hernia.

will always be found *inside* these points. The internal epigastric artery and vein usually lie outside the neck of the sac, and free from harm in the operation; but when the obturator comes off from the epigastric, and arches over the neck of the hernia to dip down on its inner side towards the obturator foramen, it may be divided when a *free* incision is made.

Situation of vessels.

Rare cases of femoral hernia occur external to the femoral vessels, as related by Partridge ('Path. Soc.,' vol. i), and others through Gimbernat's ligament, or with a diverticulum through the cribriform fascia or superficial fascia. (*Vide* Birkett.)

Diagnosis of femoral hernia.

Diagnosis.—The points already given will enable the student to distinguish a femoral from an inguinal hernia; and the great depth of an *obturator* hernia, with the fact that in this form the crural ring is *not* obstructed as it would be in a femoral hernia, ought to distinguish it.

Psoas abscess.

A psoas abscess dilates in coughing, and disappears or diminishes on the patient lying down, just as does a hernia; but it is usually placed beneath and outside the vessels instead of inside. It is accompanied by other symptoms, often spinal; and on manipulation gives the sign of fluctuation from above to below Poupart's ligament.

Varix.

A varix of the femoral vein may also in a measure simulate a hernia; but whereas in a hernia pressure over the crural ring and vessels with the patient erect will prevent its descent, in varix it will cause its enlargement.

Enlarged gland.

An enlarged gland ought not to be mistaken for a rupture, for the history of the case and concomitant symptoms generally mark its nature.

Cysts.

Cysts in the crural ring are doubtless difficult to diagnose, although from their always being in the same spot under all circumstances, and, from their not being influenced by position, coughing, &c., they are unlike hernia. When associated with a strangulated hernia they may complicate, but hardly lead to error in the case.

Treatment of femoral hernia.

Treatment.—Reducible herniæ are to be treated by a truss, the pad pressing in the hollow below and external to the spinous process of the pubes. The radical cure has been performed by Wood, Wells, and Davies, but it cannot be recommended.

Strangulated femoral hernia requires the most prompt attention, for the parts constricting the neck of the sac are so unyielding as to produce in a short period an amount of damage which is too often irreparable. In the application of the taxis the utmost gentleness should be employed, and the administration of chloroform should always precede the attempt. In the reduction of an old femoral hernia the taxis rarely succeeds.

Caution with taxis.

Mode of using taxis.

In reducing a femoral hernia by the taxis the Surgeon should always remember the position of the orifice of the sac, for when it has turned over Poupart's ligament any pressure upon the tumour can only do harm. The tumour should be gently raised by the fingers, and drawn slightly downwards before pressure is applied, backwards and upwards, and this must be of the mildest kind. Should the slightest disposition to yield be shown, the pressure may be continued, for when any of the contents of the sac are emptied, the probabilities of the reduction of the whole are greatly enhanced. Should no yielding be felt in the parts, the taxis had better be given up, and the operation performed.

On opening the sac.

In all operations for femoral hernia the reduction of the hernia, without opening the sac, should be preferred, and in "recent" hernia this "minor" operation is generally successful. The incision to expose the sac should consequently be a limited one. Luke suggested that "a fold of integuments is to be pinched up and divided by transfixing it with a narrow blade, so that the incision when the skin is replaced shall fall perpendicularly to the body, with its centre opposite to the depression, which indicates the seat of strangulation." But this plan is in a measure dangerous, for I have seen Mr. Key with the point of his knife divide all the tissues ouside the sac, and the sac itself in perforating the skin-fold.

Gay's operation.

Mr. Gay advises "an incision rather more than an inch long to be made near the inner side of the neck of the tumour. The superficial fascia to be divided, and a director or *bistouri caché* introduced down to the neck of the tumour, and through the crural ring, "by the least amount of force, and with the aid of a little gentle compression of the inner side of the tumour by the finger, the point of the bistoury may be insinuated between the sac, or rather fascia propria, and the pubic margin of the ring; the edge of the knife is then to be turned towards the pubes, and by projecting the blade the seat of stricture in that direction may be effectively divided." When a director is used or the finger, the ordinary hernia knife may be used in the same way.

Remarks on strictures and difficulties met with in the operation.

Nothing can be more satisfactory than this operation when reduction is effected by it; it should always be attempted. Should it fail, and the sac has to be opened, no harm can possibly have been caused by the proceeding, for the incision can readily be enlarged, if necessary, the sac opened, and its neck divided. Any modification of the incision may, however, be made. The essential point is, that the incision should be of such a nature as to allow the Surgeon to reach with facility the neck of the tumour. In operating the Surgeon must also remember the fascia propria or fascia that is external and superficial to the sac; it will always appear as a well-defined sac upon the division of the soft parts that cover it in, and may be mistaken for the true sac. On its division a layer of fat will often be found, more or less lobulated; this is the subperitoneal fat, and beneath this will be found the true peritoneal sac. In Gay's operation, as already described, the parts outside the fascia propria have been divided, and the division is commonly sufficient to allow of the reduction of the hernia; when it has failed, and the sac has been exposed, there is no objection to the Surgeon again dividing the neck upon a director, and should this fail, the sac must be opened. The flow of a stream of serum will probably attend this step, and, as previously stated, the nature of the fluid will indicate the condition of the parts within; the sac should be freely opened. When only intestine is seen, the director may be carefully introduced into the neck of the sac, and the constricting orifice divided, the intestine being only touched, and the gentlest pressure will then reduce the bowel. Should omentum cover the bowel, it is to be carefully raised and unravelled. Should an omental sac exist, it must be torn through or carefully divided, and dealt with as previously explained. The less the parts at the neck of the sac are disturbed the better; no introduction of the finger beyond the neck of the sac is necessary, no passing of the director or hernia knife beyond the neck

When an omental sac exists.

is called for. The neck of the sac should be divided outside the omentum. When the neck of the sac has been divided, and the sac has to be opened subsequently to ensure the reductiou of the contents, it is seldom necessary to reintrodue the bistoury, the parts yielding to the finger enough to allow of the replacement of the hernial contents, for the less the neck of the sac is divided the better. The Surgeon should always be careful that the hernia is not reduced within the crural ring, together with the sac; if so, the sac must be brought down again, opened, and held *in sitû* whilst its contents are returned. The after-treatment of the case is to be based upon the same principles as have been already laid down.

When sac opened.

Obturator Hernia,

or hernia through the foramen of that name, deserves a passing notice, for its successful treatment can only follow its diagnosis. It is more common in females than males, and is often unattended by any external evidences of its existence. Birkett has collected twenty-five examples of this affection; in fourteen the hernia was not discovered till after death. In three only was a successful operation performed: by Obré in 1851, Bransby Cooper in 1853, Lorinson in 1857. Mr. Cooper's case I had the good fortune to see.

On obturator hernia.

Its rarity.

The sac of the hernia is always an "acquired" one; it emerges in the thigh between the adductor longus muscle and femoral vessels, beneath the pectineus muscle. The hernia is consequently on a lower level than the femoral, and comes forward instead of downward. But a tumour is not always to be felt under these circumstances, and a diagnosis is to be made out of the general symptoms; and of these, pain in the course and distribution of the obturator nerve is the most marked. In several of the recorded cases, during the development of the hernia, the pain described as "spasmodic contraction of the abdominal muscles" was most marked, and this fact is explained by Birkett by recalling the association existing between this nerve and the muscular filaments distributed on the abdominal muscles, all being branches of the lumbar plexus. Birkett also notices that movement of the hip-joint in the affected side excites or aggravates the pain, as well as deep local pressure; and pelvic examination, either per vaginam or rectum. With these symptoms associated with those of strangulated hernia, an exploratory operation in the region of the hernia is justifiable, should the taxis fail.

The sac always an acquired one.

Diagnosis.

Treatment.—The taxis can hardly be expected to be a successful proceeding in obturator hernia, the sac being so low down in the thigh and so little under control. Nevertheless, it should be tried, with the adductors relaxed, by means of steady pressure applied downwards in the hollow of the thigh, and inwards between the adductors.

Treatment of obturator hernia.

To explore the parts an incision should be made below Poupart's ligament, and to the inner side of the femoral vein, down to the pectineus muscle; this may then be divided. Should no sac appear, and the obturator foramen, covered by its muscle, be reached, the fibres of this muscle must then be separated, and the obturator canal found; for a small hernia may be well hidden by the muscle. Should a sac be felt, the parts constricting it must be divided by a knife,

Operation for obturator hernia.

and its contents reduced. The obturator nerve should not be wounded, if possible.

Umbilical Hernia.

On umbilical hernia.

This is a common affection in children from want of closure of the umbilicus; in fat women, and others who have had many children, it is far from rare. In men it is also met with; it forms 5 per cent. of all cases of hernia, and 6 per cent. of cases of strangulated hernia.

The sac is an acquired one.

The *sac* of this form of hernia is an acquired one; it is always formed, both in the infant and adult, by the pushing forwards of the parietal abdominal layer of peritoneum. The parts covering it in are only integument and fascia, the internal abdominal fascia being over the true sac; these parts are occasionally very thin. The tumour at times attains a large size, and as it generally increases *downwards*, the Surgeon must look for the neck of the sac at its upper part; these herniæ at times assume odd shapes.

Treatment of umbilical hernia.

Umbilical truss.

TREATMENT.—When reducible, and in an infant, a cure may with some confidence be promised; indeed, in the majority of cases in young life the opening in the navel will contract, if care be observed to fix over the part with strapping a *flat* elastic ring or pad covered with leather; a convex pad tends to keep the ring open. A belt or truss in early life is a delusion, it never keeps its place. In lieu of a pad, it is a good plan to pinch up the integument over the hernia with the thumb and finger and to turn the fold sideways upon the umbilical opening, fixing it in its position by strapping; waterproof strapping being employed. The folded integument by this method acts as a pad and assists recovery.

Messrs. Lee, Barwell, and Wood have suggested an operation for the closure of the umbilical orifice, but such a measure cannot be recommended; to risk life unnecessarily for an affection that is mostly curable by means of time, and natural processes assisted by art, is hardly justifiable.

Adult patients with reducible ventral hernia should also wear some mechanical appliance, such as a ring truss; and an irreducible rupture should be protected by a cup truss.

When large and irreducible.

When these tumours are large and irreducible, they give rise to troublesome abdominal symptoms. They are apt, indeed, to be the best examples the Surgeon sees of so-called obstructed hernia; fæces and flatus get into the strangulated intestine and cannot get out, thus causing nausea, colic pains, and constipation. Rest in the horizontal position, the local application of ice, a good enema to empty the lower bowel, and a purge to clear out the upper, will often, under these circumstances, prove of great benefit; and such means should be tried in all cases.

When strangulated.

When general symptoms of strangulation exist together with local signs, such measures must not, however, be thought of. When vomiting, constipation, local pain, and an absence of impulse in the tumour are persistent, the reduction or freedom of the mass from strangulation by operation must be entertained; and with a patient under chloroform the taxis, as a rule, proves successful. In applying it to a large tumour, where it is probable a fresh descent of intestine has taken place, and the symptoms are due to its strangulation, the Surgeon

Taxis under chloroform.

should examine the tumour carefully, to make out if one part be more tense than another; for if it be, the taxis should be applied to the tense part in preference to the other. On several occasions, by adopting this practice, I have been able to reduce the strangulated portion of the contents of a hernia with complete success.

Operation for umbilical hernia.

Should herniotomy be called for, it is a matter of immense importance that no manipulation of the contents of the sac should take place. When the sac is opened and the parts exposed, it is an exceptional occurrence for any cure to follow, no cases of hernia being more fatal than the umbilical under these circumstances. When the sac is not opened so as to expose its contents, or only opened at its neck, to allow of the division of the strangulating orifice, a good result may be looked for.

In every case in which I have adopted this practice, a good result followed, the oldest patient being seventy-four years of age, and the strangulation of five days' standing.

When neck of sac only to be divided.

In irreducible hernia of large size and of long standing, when reduction of the contents of the sac, as a whole, cannot be expected, and there is no evidence of strangulation within the sac by some of its contents, the Surgeon should be satisfied with dividing the neck of the sac, and thus relieving the strangulation, he may then by gentle taxis reduce what will return, but he should do no more. To explore the whole sac, and to expose the irreducible bowel to the air and to manipulation, is an unnecessary practice; and every Surgeon knows how fatal it is. In a case I had in 1874 with Mr. Brockwell, of Sydenham, in which, in a lady, an irreducible hernia of seven years' standing became strangulated, I simply divided the neck of the sac and left the parts alone, and the whole contents of the sac in two days returned, a rapid and complete recovery taking place. At times a *double sac* is found in umbilical hernia. Some time ago I was called upon to operate in such a case. The woman was aged 44, and had been ruptured for years, the hernia being irreducible. She came under my care at Guy's, with symptoms of two days' strangulation. The rupture was clearly inflamed, the slightest manipulation causing intolerable pain. Under chloroform I cut down upon the tumour, and found two distinct sacs, their orifices placed laterally, being separated by a piece of dense fibre tissue. One contained a mass of sloughing omentum, the second, intestine, which was black from congestion, and covered with lymph. The contents of each were reduced separately on incising the orifices of the sacs; the patient died, and no examination after death was allowed. In another case I found a strangulated bowel in a small omental sac introduced into an irreducible hernia.

When a double sac exists.

On ventral hernia.

A ventral hernia is a term applied to any protrusion through the abdominal walls, not belonging to the usual forms. Most of them are found in the linea alba above the navel. One of the largest I ever saw was over the right iliac fossa; it followed a rupture of the abdominal muscles caused by a fall of twenty feet upon the handle of a pump. It was the size of a man's hand, and strangulated. By the taxis I reduced the mass, and by the use of ice locally, and opium internally, the man recovered. He had, however, to wear a pad subsequently to support the part.

After the operation of ovariotomy a very large protrusion will take place if a good belt be not worn. The same may arise after the weakening of the abdominal walls from abscess.

When the hernia takes place below the xiphoid cartilage it is called *epigastric*. When it takes place in the loins, *lumbar*. Birkett quotes two such cases.

On perineal hernia.

Perineal hernia descends in front of the rectum; it is most common in women; it appears in the perinæum. When the hernia descends outside the vagina along the ramus of the ischium, it shows itself in the labium, *labial* or *pudendal hernia;* when it appears in the vagina, *vaginal hernia.*

Vaginal and labial herniæ may be mistaken for the mucous cysts of those parts; but the herniæ are reducible, and when irreducible or strangulated, they give rise to symptoms indicative of these conditions. The cysts are only local affections, they cause no general symptoms; they are tense, elastic, globular tumours fixed in the tissues, and have *no neck* passing upwards into the pelvis.

On ischiatic hernia.

Ischiatic hernia is a hernia through the sciatic notch, above or below the pyriformis muscle. The gluteus maximus muscle covers it in; but as the hernia enlarges, it may appear below the lower border of that muscle. Dr. F. C. Crosse, in Sept., 1873 ('Dublin Journal of Medical Science'), has recorded an interesting example of this kind; it was in a woman, æt. 40; the tumour occupied the lower border of the right gluteal fold; it was the size of a fœtal head, soft and pulpy to the touch, dull in parts, tympanitic in others; coughing gave an impulse to it. It was treated by a truss. Should such a rupture become strangulated, an operation must be performed, the Surgeon making such an incision as will best expose the tumour with its neck.

On diaphragmatic hernia.

Diaphragmatic hernia is also a surgical affection, and when the result of an accident is generally fatal; it has been alluded to under the heading of "Abdominal Injuries."

It may also be the result of some congenital defect, or the pushing of the abdominal viscera through one of the natural openings in the muscle.

On Trusses.

Description of truss as to use.

A truss is an instrument employed for the purpose of preventing the descent of a hernia. It is composed of a pad, to be placed over the seat of the hernial protrusion, and a spring or belt to keep it in position. Any truss that will keep up the hernia under all circumstances, and does not cause pain or lasting discomfort, is probably a good one. Every truss that fails to carry out this object must be condemned. An instrument with a too feeble spring is a delusion and a snare; an instrument with too powerful a one may tend to do more eventual harm than present good, by causing absorption of the abdominal parietes upon which it presses, and, as a consequence, enlargement of the opening through which the hernia descends; for the same reason a very convex pad is also to be condemned.

A truss that will keep up one hernia may fail to do so in the case of another. Every hernia, in fact, requires a special adaptation of the pad, and a carefully regulated spring.

When to be worn.

Every subject of a hernia, young or old, male or female, should wear a truss, and in a good proportion of cases, particularly of the young, a cure may take place; that is, the neck of the sac may close. But even after a cure, or apparent cure, has taken place, it is well, for the sake of safety, to wear the instrument; for cases are far from infrequent, when a supposed cure had taken place, and after the lapse of years, a sudden descent has occurred, jeopardising life. In the congenital form of hernia this is the more common.

The truss should be worn all day, from the act of rising out of bed to that of retiring, for its object is to prevent the descent of the hernia under any sudden act of exertion, and with the truss off it is impossible to guarantee that any such may not be made. The habit some patients have of taking off their trusses when they are sitting in their drawing-room is one to be condemned, for I have more than once been called upon to treat a strangulated hernia which came down under these circumstances, during some unguarded act; and it is in this unguarded moment that the truss is calculated to be of use.

When the truss is first applied, it will doubtles cause inconvenience, but this will soon pass away. The use of plenty of starch or violet powder, the bathing of the point of pressure with some spirit and water, and attention to keep it very dry, remedy any little local source of discomfort.

On the pad of a truss.

The pad.—This should be regulated according to the size of the hernial aperture. A small opening requires a small pad; a large opening, a large one. The pad should always overlap for about half an inch all round the hernial aperture, and in large herniæ, more. The pad should be slightly convex when made of any yielding material; and flat, when of a firmer consistency. It should also be so adapted to its spring as to keep its place under all circumstances.

It should also, in inguinal hernia, be so fixed to the spring as to exert a pressure at right angles to the plane of the hernial aperture. Thus, in large pendulous bellies, the pressure may be upwards, or inwards and upwards; in thin subjects directly backwards. In femoral rupture the pressure should always be backwards, to close the crural ring. Any truss that applies its pressure only in one direction must fail in its purpose in a large number of cases. It is, indeed, in this curve of the spring, or direction in which the pressure of the pad is employed, that the chief difference in the great varieties of trusses is found.

Some pads are rigidly attached to the spring that holds them in position, while others are connected by means of movable joints of different construction. Salmon and Ody's well-known truss has a ball-and-socket joint.

On the spring of a truss.

The spring of a truss is a point of importance, although it is not so important as the pad and the direction of the line of pressure. Its strength is to be carefully regulated according to the requirements of the individual case. It must be strong enough to keep the pad in position, and prevent the descent of the hernia under all circumstances, but not so strong as to cause pain. The French spring consists of a coil, like that of a watch-spring, it is always in action, and presses inwards. The German form is more rigid and inelastic; it holds the pad in its place and resists the protrusion of the hernia under any expulsive effort. The English makers employ a variety of springs. A too rigid one, as the German, is not to be recommended, whilst the French is likewise objectionable, as its action is too severe and too constant.

The best spring is one that holds the pad in position, keeps it there under all movements, counteracts any expulsive action of the hernia, and causes little if any discomfort. The lighter it is, under these circumstances, the better, and the closer it is adapted to the body the more comfort it affords.

The Moc-main lever.

The only truss that has no circular-body spring, and is kept in position by a band is the Moc-main lever. The pressure is kept up by means of a thigh strap attached to a small spring-lever connected with the pad. Such a truss is comfortable, there is little doubt, for its action is not enough to produce inconvenience, but it is not a safe truss under most circumstances. In old people, where the inguinal rings require only a little support, it may be used; but in the middle-aged, when the hernia has a tendency to come down, it is a dangerous and unreliable instrument.

Situation of pad of truss on rings.

In oblique inguinal hernia the pad of the truss should be placed *over the internal ring and canal*, not over the external ring, the object being to give support to the weak internal ring; in direct inguinal it is placed over the external ring. In femoral hernia, when the crural arch is natural and not relaxed, a small pad may be employed over the neck of the sac; when relaxed and moveable, a large one, the pad being so adjusted as to press upon the ligament itself. After the operation of herniotomy for crural hernia, this point is worthy of attention; for when a free division of Gimbernat's ligament has been made, the neck of the sac is always large and the ligaments are relaxed.

To give a description of every variety of truss is needless.

Varieties of trusses.

Egg's truss is a rigid one in all respects, and keeps its place well when once fitted. *Coles's truss* is a very good one; it is light, and has a thin metallic pad covered with leather, and acted on by spiral springs. When properly adapted with a not too convex pad, it gives a good elastic pressure; but it is not so well calculated to retain a hernia under violent exertion as another truss with a more solid pad; the elastic pad is apt to yield and allow the hernia to descend. This same objection applies to all elastic pads, although air or water pads, in some cases, are very comfortable and very valuable, particularly in the healthy aged subject.

Among the trusses with solid pads that of Wood's must be mentioned. They are made by Matthews, with flat pads, composed of wood, ivory, or vulcanite, an india-rubber water-bag being occasionally applied to the surface of the pad. They are held in position by a spring that encircles the body. The size of a pad varies with the nature of the hernia, and the size of the hernial aperture. For oblique inguinal hernia the pad is of an obliquely curved horseshoe shape, the outer limb over Poupart's ligament being shorter than the inner, and the spermatic cord and pubic spine lying in the cleft. The curve of the horseshoe is placed over the inner hernial aperture. For direct inguinal or umbilical hernia the pad is made the shape of an ovate ring with a hole in the centre, corresponding to the hernial opening. For femoral hernia the pad is egg shape.

Newsom's truss has a thin round wire-spring, and a hard pad, which is very comfortable when well adapted.

The truss of Dr. C. Edwards, of Cheltenham, is a good one, the pad being so arranged that it may revolve as well as slide on the spring when required. That of Salt's, of Birmingham, also, and L'Estrange's, are good instruments.

A simple and yet a very efficient truss has, for some time past, been made by Messrs. Krohne and Sesemann, designed by Mr. R. Rendle, late surgical registrar at Guy's, for keeping up either a single or a double rupture. It consists of a circular steel spring covered with vulcanite, and made to fit closely around the pelvis, one inch below the hip. In both ends of the spring a slott is made, in which slide vulcanite pads, one for the left and one for the right side, which are to support either a single or a double hernia. If a hernia exists on one side only, the spring pressure on that side is made the strongest, and the pad on the other side in these cases acts as a protection from rupture, to which persons ruptured on one side are predisposed.

The main objects of a truss.

But what I want the student to understand is, that a truss to be of use must answer to a nicety the purpose for which it is required. The pad is to be adapted to the abdominal hernial orifice, and not below it, or to the hernial tumour itself. The amount of pressure applied to the pad is to be carefully regulated as well as its direction, enough being employed to keep the pad in position under all circumstances, without causing pain. A slight force applied in the right direction is of greater value than a greater one misdirected.

The pad may be flat or slightly convex, and it may be made of a solid material; or, if of an elastic one, air, water, or springs may be employed, according to the requirements of the case. Sand pads are of great value, for they can be moulded to fit more comfortably and accurately than any other.

To test the value of a truss.

To test the value of a truss.—The patient should be made to cough and strain, and when possible to jump; he should be placed on the edge of a chair with his legs apart, or made to stoop forward, with his knees apart and his hands resting on his knees, and then to cough, these positions tending more than any other to relax the lower parts of the abdomen and loosen the truss. Should the hernia by these means fail to descend, or should the coughing, &c., fail to excite in the patient a sensation of weakness in the part, the truss is probably an efficient one. But the Surgeon, under all circumstances, should explain to his patient what the truss is expected to do, and point out to him the extreme danger he will incur should it fail to do it, and the necessity of again seeking advice.

The Surgeon should, moreover, always take upon himself the responsibility of seeing that the truss fits, and not rest satisfied by sending his patient to buy a truss where he likes and of what kind he likes. The Surgeon should tell the maker what he wants, and not leave him to find it out.

To measure for a truss.

To measure for a truss.—The following points should be noticed:—The nature of the hernia, the size of the hernial aperture, the side, and if double. Give also the circumference of the pelvis, one inch below the crest of the ilium, and the girth of the body, commencing and ending at the hernial orifice, also the distance from the hernial aperture to the iliac spine. The Surgeon should, moreover, always indicate to the maker the directions of the pressure required by the pad, and this is always to be made out, when the patient stands, by a digital examination. In pendulous and fat subjects, in inguinal hernia, it may be upwards, backwards, and inwards, in thin subjects simply backwards; but this is a point upon which no general rules can be laid down, and yet one upon which the whole value of the truss depends. In femoral rupture the plane of the crural ring is horizontal, and it may be closed by a backward pressure. The Surgeon should always look to this point himself.

To estimate the force required to keep the hernia in position is a difficult thing. Up to the present the only true test is that of trial. Mr. Wood has, however, had an ingenious pressure-gauge made for the purpose, which may possibly turn out of value. ('Brit. Med. Journ.,' October 12th, 1871.) Mr. Holthouse has recently invented a skeleton truss which promises to be of great use for indicating the length and shape of the spring required, and the correct angle at which the pad should be fixed.

Extra spare truss.

Patients who are apt at times to employ great muscular exertion should have two trusses, one for ordinary wear, with a sufficient press power to keep the hernia in position, and the second with an increase of power, the second one to be put on when occasion demands. They should also have extra bathing trusses.

When a double truss to be used.

When any tendency exists for a double hernia, as indicated by a bulging of the opposite ring or a sense of weakness on making exertion, a double truss should be worn; indeed, in inguinal hernia particularly, I am much disposed to think that a double truss should always be employed. It is as comfortable as, and often more comfortable than, a single one. It is an extra protection, and, if well adjusted, can do no harm.

Birkett, 'Holmes's Syst.,' vol. iv, ed. 1870; 'Med.-Chir. Trans.,' 1859.—*Bryant*, 'Guy's Reports,' 1856; 'Clin. Surg.,' Part 3, 1861.—*Cooper's* 'Surgical Dict.,' 8th ed.—*Gay*, 'On Hernia,' 1848.—*P. Hewett*, 'Med.-Chir. Trans.,' 1844.—*Hutchinson*, 'Lond. Hosp. Rep.,' 1865.—*James*, 'On Hernia,' 1859.—*Aston Key*, 'On Hernia,' 1833; 'Guy's Rep.,' 1842.—*Kingdon*, 'Med.-Chir. Trans.,' 1864.—*Luke*, 'Med.-Chir. Trans.,' vol. xxvi and xxxi.—*Lawrence*, 'On Ruptures,' 1835, 5th ed.—*Stephens*, 'On Obstructed Hernia,' 1829.—*Scarpa*, Wishart's ed., 1814.—*Ward*, 'On Strangulated Hernia,' 1854.—*Wood*, 'On Rupture,' 1863.

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CHAPTER XVI.

SURGERY OF THE ANUS AND RECTUM.

(Malformations.)

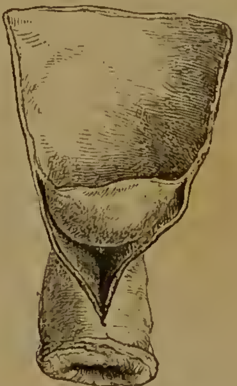
Varieties of malformations of anus and rectum.

The anus and rectum are not rarely the seat of congenital malformations, and these show themselves in a great variety of forms. In one class of cases the anus is completely closed, the rectum being either partially or wholly deficient; in a *second* the anus exists in its normal condition, but opens into a *cul-de-sac*, the rectum being partially or wholly deficient (Fig. 242); and in a *third* class the anal orifice is absent, the rectum opening into the bladder, urethra, vagina, or other abnormal position. And it will be observed, says Mr. Curling, to whom we are indebted for the bulk of our information on this subject ('Med.-Chir. Trans.,' vol. xliii), that the classification of these imperfections is founded on states that can generally be recognised during life; although, unfortunately, the conditions of the terminal portion of the intestinal canal, and its relation to the parts around, cannot be predicated with any certainty; for in cases of imperforate anus, or of anus opening into a *cul-de-sac,* the intestinal canal may terminate in a blind pouch at the brim of the pelvis, the rectum being wholly wanting; or an imperfect rectum may form a short sac, descending to the floor of the pelvis, or so low as the neck of the bladder in the male, or commencement of the vagina in the female. An explanation of these different conditions is to be found in the fact that these malformations are also clearly due to some failure in the fœtal development; for the anal portion of the bowel is developed independently of the upper portion; and the two parts subsequently advance, and, in a natural condition, unite, the membranous diaphragm at the point of junction, at a later period, disappearing by interstitial absorption. When a failure in this uniting process takes place, the second class of congenital imperfection is formed; when the failure occurs at an early period of development the two ends of the approaching tubes will be far distant, and when at a later period they may be in closer contact.

Anal cul-de-sac.

Sometimes the blind pouch in which the intestinal canal terminates is connected with the anal integument, or with the anal *cul-de-sac,* by a cord prolonged from the bowel above, and it seems possible, from Curling's and MM. Goyrand and Friedberg's observations, that such cases are caused by an obliteration of the bowel, which was originally well formed, owing to some intra-uterine inflammatory action; some instances being recorded where the muscular tissue of the intestine was clearly traced into the cord.

FIG. 242.



Showing the intestine ending as a cul-de-sac above the anus. Prep. 1882^{75}, Guy's Hosp. Mus.

The closure of the anal orifice is due to a firm adhesion of the integument; where the upper bowel communicates with the urinary or vaginal passages, it is owing to the incomplete separation of the natural cloaca that exists in the development of those parts.

A clear understanding of the way in which these deformities are caused will explain the difficulties that are met with in their treatment.

Treatment where anal cul-de-sac.

TREATMENT.—The condition of the different outlets of the body should be invariably examined on the birth of every child, and even when the anus appears normal, a digital examination should be made on the second day, when the bowels have failed to act, for many an infant's life has been lost for the want of this attention and the postponement of surgical relief till too late a period.

When simple.

In the *simplest* cases, when the anus is closed by a thin membrane, and the bulging of the distended rectum indicates its nature, a cautious central incision through the soft parts should at once be made, and a good result is generally obtained, the power of the anus usually being complete.

When complicated.

In the *more complicated* cases, where the anus is closed or absent altogether and *no bulging of the bowel exists,* and where the Surgeon has no means of making out the true position of the terminal end of the bowel, a cautious incision over the spot in which the anus exists or should exist may be made, but it must be carried out with care, the finger of the left hand acting as a pilot. The incision may be free as long as it is carried upwards and backwards towards the sacrum, and not forwards towards the urethra or vagina. It must not, however, be made too high. Where there is not sufficient room to carry out this practice the coccyx may be cut away.

Avoid deep exploration.

Should these means fail, all further attempts must be given up. To introduce a knife or a trocar and canula blindly upwards, with the vain hope of puncturing the distended bowel, is a practice which must be unhesitatingly condemned. Indeed, Mr. Curling's figures prove that the perineal exploratory operation, unless undertaken with great care, does more harm than good; but when skilfully performed it is followed by good success.

Treatment where cul-de-sac high up.

In the treatment of the second class of cases, in which the rectum terminates above in a *cul-de-sac*, an exploratory operation may be made as just described, but the uncertainty as to the true position of the bowel renders any operative proceeding hazardous. When the two tubes are in contact, and only separated by their membranous ends, as in the case illustrated (Fig. 242), a good result may be expected. When they are far apart no good can result. Mr. Curling gives in his table 31 examples of this class of cases. In 27 of these an attempt was made to reach the bowel, and in 16 with success, and 10 of these subsequently recovered.

Intestine to be drawn down if possible.

When the bowel is opened in any of these cases, and is not far from the anus, the Surgeon should use all fair endeavours to draw down the intestine to the margin of the external opening and fasten it with sutures to the skin. He cannot often, however, succeed in doing this, the bowel being rarely found at a less distance than an inch from the perinæum; but when he can, the advantages of the practice are great.

Repeated dilatation.

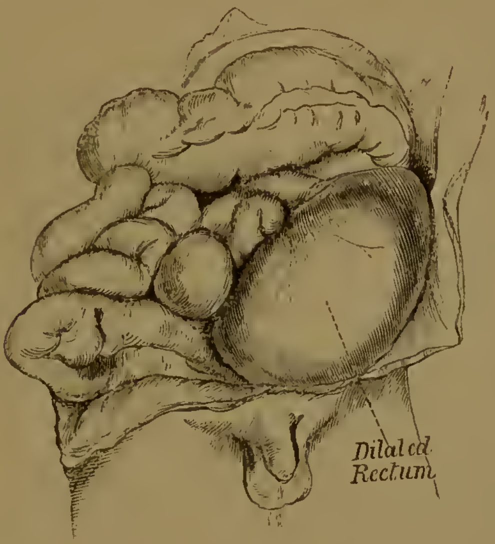
Where this cannot be done, repeated dilatation of the perforated bowel is absolutely essential to maintain its patency, for otherwise, like all artificial openings, its subsequent contraction will take place. The introduction of a finger once or twice a week is sometimes enough for this purpose, and in a case I had under care, where the tendency to contract rapidly was marked, the introduction of a large sea-tangle tent answered admirably, the tent being placed in water for a few minutes to make it swell before it was introduced.

Tendency of opening to close.

When the anus opens in an abnormal position, as in the vagina, and the anus made by the Surgeon is established, there is a natural tendency for the abnormal opening to close, several cases being on record in which this result ensued. Two have occurred in my own practice. When success has followed any operative procedure in these cases, it is important that close attention should be paid to the condition of the bowel for many years, indeed for the whole of life, for there seems reason to believe that the bowel which forms the upper *cul-de-sac* has but little muscular power, and that it is prone to dilate under fæcal collection and to become paralysed. Death under these circumstances takes place from obstruction. In Fig. 243 this fact is illustrated; it was taken from William L—, æt. 26, who had been operated upon as an infant for an imperforate rectum. He died from peritonitis June, 1874, due to intestinal obstruction, which was clearly due to retained motions in the upper part of the large intestine above the seat of the old operation.

When the exploratory ano-perinæal operation has failed to give relief, or when it is expedient to make the attempt from the very

FIG. 243.



backward position of the genital organ, other measures must be adopted, and of these the opening of the large intestine through the abdominal walls is certainly the best. M. Rochard, in the 'Mémoires de l'Académie Impériale de Médecine,' 1859, gives ten authentic successful cases of Littre's operation in the groin for this affection; but Guersant opened the colon in the groin eleven times in succession, and once in the loin, without saving one patient. Holmes tells us, in his admirable work 'On the Surgical Diseases of Children,' that he had not met with the account of any permanently successful operation since the publication of Rochard's paper. Giraldès had, however, one case in which a child lived two months and a half, and died of another cause.

Operation through the abdominal walls.

The operation, however, to be successful, must be undertaken early, before the infant is exhausted and peritonitis has set in. Delay is only justifiable when the bowel is not distended, and the symptoms are not in any way urgent.

Inguinal operation.

With respect to the form of operation, that known as Littre's is probably the best, viz. opening the bowel in the groin; the left groin is the one usually selected, although the right has been recommended by Huguier, on account of the absence of the rectum in these cases, and the frequent bend in the colon towards the right groin. Giraldès has, however, shown from dissection that in thirty infants operated on for imperforation, the intestine was found on the left in all. ('Nouveau Dict. de Méd. et de Chirurg. pratiques,' 1864.) I have on two occasions performed Huguier's operation with temporary

Lumbar operation.

success. The question is, therefore, still *sub judice*. Amussat's operation in the loin is rightly put aside in these cases on account of the natural looseness of the colon at this part in children, and the very usual oblique turn of the colon after its splenic flexure. Figures likewise help towards the same conclusion, for out of fourteen instances in which Littre's operation was performed nine recovered, whereas only two out of seven recovered after the lumbar operation.

The operation itself will be described in a future page.

Treatment where rectum opens into vagina.

In the treatment of the third class of cases, where the rectum opens into the vagina, the Surgeon may lay open the rectum from the position of the natural anus into the vagina, having previously passed a director into the vaginal orifice of the gut as a guide, drawing down, when possible, the bowel, and fastening it to the integument by sutures, as originally performed with success by Amussat; or he may perform an operation in the region of the anus similar to that which has been described in cases where no vaginal orifice existed, and this operation is the better of the two. As a guide to the perinæal incision, the Surgeon may pass a bent probe into the vaginal orifice of the bowel, and turn the end towards the perinæum, cutting down carefully upon it. I have done this with success in four cases, and in all stitched the bowel to the margin of the integument, forming a good anus. In two cases the vaginal orifice subsequently closed. In two of the cases that were operated on several years ago, the patients have good control over their motions and the vaginal fæcal fistula seems to be contracting, liquid motions alone passing.

In exceptional instances the deformity seems to cause no inconvenience. Ricord has recorded one ('Gaz. des Hôp.,' 1863) in which the woman was married, and her husband was quite unconscious that anything abnormal about the parts existed. Le Fort has recorded a second in which the woman was married, and had had three children, the malformation having been accidentally discovered by the doctor in an examination for some suspected disease of the bowel.

"In such cases as these," adds Holmes, "the termination of the rectum in the vagina must be tolerably free, and there must either be an external sphincter or the internal sphincter must be hypertrophied."

Where the bowel opens into the bladder or urethra.

When the *bowel empties itself into the bladder or urethra*, the case is a very hopeless one. An exploratory operation in the region of the anus may, however, be made with the usual caution, with the hope of reaching the intestine, and on its failure Littre's operation should be performed. When the rectum opens into the urethra, the prospects of a successful issue of the case are better than when it opens into the bladder. Mr. Curling has related one case in which permanent success followed treatment. The boy when seen by Mr. Curling was eight years old; he had a good anus in the groin, but still suffered from the occasional passage of fæces into the urinary passages.

Summary.

By way of summary the following conclusions may be given:

1. In all cases, with some rare exceptions, whether of imperforate anus, obstructed rectum, or misplaced anus, an exploratory operation in the normal anal position ought to be made, success following the attempt in nearly half such cases.

2. Such exploratory operations, however, to be successful, must be

undertaken early, and conducted with great caution. The line of puncture or incision should be upwards and backwards towards the sacrum.

3. When these means fail, or are inapplicable, the intestine is to be opened in the groin, it being still an open question whether the right or left side should be selected; the latter is the usual one.

4. When an artificial anus has been made, its constant dilatation is a necessity.

For further information on this subject refer to Curling's paper, 'Med.-Chir. Trans.,' vol. xliii, and French edition of Holmes's 'Surgical Diseases of Children,' by Dr. Larcher. Bodenhamer, Wm., 'On Malformations.' Wood, New York, 1860. Ashton, 'On Rectum,' 3rd ed., 1860.

Injuries of the Rectum.

Injuries of the rectum.

The anal orifice and lower part of the rectum may be wounded by accident from falls, or by design, and when this occurs hæmorrhage is a common result. Repair, however, rapidly goes on in these regions, and with the arrest of bleeding by securing the divided artery, or pressure, and water dressing, a good result may be anticipated.

Ruptured rectum in parturition.

In parturition the rectum is sometimes laid open by a rupture, either alone or with the perinæum, and when this occurs the rent ought to be brought together at once, for if this practice be not adopted, a plastic operation will have to be performed subsequently.

Laceration from act of defæcation.

In the *act of defæcation* small lacerations of the anus are not uncommon when the motions are very large or hard; and H. Mayo ('Dis. of Rect.,' 1833) relates the case of a lady who, during a violent effort at defæcation, felt something give way, and on the following morning discovered fæces in her vagina. An examination revealed a rent two inches up the bowel, large enough to allow the end of the finger to pass from the rectum into the vagina. Cases are also on record when during parturition a child's head passed into the rectum, and was delivered per anum.

Treatment.

In the milder forms of laceration of this kind, cleanliness and laxatives are, as a rule, sufficient to allow the parts to heal. In some instances the rent does not heal and the case becomes one of fissured anus or painful ulcer of the rectum, and must be dealt with accordingly.

Wounds of the rectum inflicted by the Surgeon as a rule heal readily, as the cases of fistula in ano treated by operation, and the recto-vesical operation for stone, fairly prove. The puncture made in the operation of tapping the bladder per rectum also heals quickly.

It is well to remember that the rectum may be wounded by the passage of a bougie, enema syringe, or the introduction of an O'Beirne's tube. The Guy's Museum contains specimens illustrating all these forms of injury, and at St. Bartholomew's there is a specimen of perforation of the rectum by a metallic clyster pipe, through which gruel was injected into the peritoneal cavity.

Foreign Bodies in the Rectum.

Foreign bodies in the rectum.

These may be introduced from *without*, either from mischief or accident, and some trouble may be experienced in their removal, their shape and position influencing the result. More commonly, however, they have been swallowed, and have passed down the canal, becoming caught or impacted in the rectum. They are not infrequently the cause of anal abscess; bones, pins, bristles, &c., being constantly found in the rectum under these circumstances. Stones, hair, or husks may likewise form concretions that are foreign bodies. When large foreign bodies have been introduced into the rectum, or concretions or solid masses of fæces become impacted there, chloroform should be given to allow of their removal, care being taken not to injure the walls of the bowel more than can be helped. With the patient under the influence of chloroform, the sphincters become so relaxed as to allow of the introduction of large instruments, or even the introduction of the hand to guard the bowel and remove the foreign body. Bottles, pots, cups, corks, rings, pencil cases, bougies, sticks, &c., have been impacted in these regions, and considerable care is needed to remove them without causing injury. The injection of plenty of warm oil before the attempt greatly facilitates the operation. Lithotomy scoops or forceps are likewise valuable, but the ingenuity of the Surgeon is called for in every case to find the best means to carry out the end in view.

Treatment.

A large collection of such cases with their treatment is given by M. Morand in 'Memoirs of the French Academy of Surgery,' vol. iii, and by Ashton in his work 'On the Rectum.'

The Diseases of the Anus and Rectum.

On diseases of the anus and rectum.

Their study neglected.

The diseases of the rectum and anus have only recently received sufficient attention from the great body of Surgeons, and, as a consequence, they have been too often allowed to fall into the hands of "quacks;" and although able and respectable specialists have since rescued this important classes of cases from their hands, much remains to be done by the profession as a whole to bring the diseases of these parts into their right position into the hands of the general practising body of the profession. Again, in no class of cases are so many mistakes met with as in this, and these mistakes almost always arise from a want of proper local examination of the parts. The anus or rectum is either unlooked at or unexamined from some mistaken notions of delicacy, or badly examined from want of knowledge or want of inclination. But such things should not be, and every patient who complains of anything like persistent symptoms in those regions should be as carefully examined as he or she would be were any other locality equally affected. To do this some nicety is required, and to help the student the following hints may be acceptable.

Examination of a patient.

Mode of examining the rectum.

The best position is on the side, with the legs well drawn up and thighs flexed upon the abdomen, the hips being brought to the edge of the bed or couch in a good light; with one hand, the Surgeon having uncovered the parts sufficiently to expose them, may then raise the upper buttock, and in doing this the anus comes well into view; in operations this may be done by an assistant. When an abscess exists it will then be seen; if a fistula be present, its external orifice will be apparent. Fissures, warts, condylomata, or fleshy, flattened, cutaneous vegetations, or cancerous tubercles, will also be at once recognised.

Loose folds of skin.

Pendulous loose folds of skin about the anus will suggest the former existence of external hæmorrhage; blue turgid venous projections their present existence. A tightly contracted and rigidly drawn up anus as a rule means some painful ulcer of the part, and a patulous anus through which flatus or discharge passes without the patient's wish, too often means extensive rectal ulceration or stricture.

For internal piles.

Internal piles when prolapsed will appear as turgid, vascular, mucous projections, surrounded by everted integument more or less œdematous, and covered with mucus or blood; prolapsus recti, as a greater or less annular projection of smooth or rugous mucous membrane, with a central intestinal orifice. A polypus projecting will appear as a cherry, surrounded by healthy structures. All these points are taken in at a glance, and interpreted. A digital examination is then to be employed to confirm or refute the suggestions thus taken in by the eye. To do this well the index finger should be thoroughly anointed with lard or ointment, it being a good plan previously to fill the nail with a piece of soap; it should then be applied to the anus, and the patient told to bear down, for in doing this the sphincter is relaxed. The Surgeon may then with ease, and without pain, introduce his finger. When an ulcer exists at the anus pain will be caused by, and spasmodic resistance to, the introduction of the finger, and with the pulp of the finger slowly moved round the anus, the ulcer will probably be felt; it should be stated, however, that in many cases this ulcer will be seen by a careful drawing down of the skin of the anus till the margin of the mucous membrane becomes visible. A spongy nodular feel of the mucous membrane just within the sphincter will suggest internal hæmorrhoids; a local, tender, and raw surface the probability of a simple ulcer; a circular indurated raw surface that of a syphilitic sore, while a cancerous ulcer is known by an infiltrated nodular and thickened surface. A stricture within two inches of the anus can always be detected by its annular form or the obstruction which it causes. When a healthy piece of bowel separates the anus from the stricture or ulceration, the probability of the disease being cancerous is rendered great. When no such healthy tissue exists, syphilitic disease is rendered probable. A digital examination will always detect the presence of scybala or impacted fæces, and also the encroachment of uterine or pelvic tumours in women, and prostatic tumours in men.

For ulcer in the rectum.

For stricture of rectum.

For cancerous disease.

To confirm these opinions thus formed, a speculum may be used; and this should be introduced well warmed and greased in the same way as the finger.

Use of speculum.

Mr. Allingham "advises the prone position, with the hips well elevated upon hard pillows, to such an inclination that the intestines will gravitate towards the diaphragm, so that when expiration takes place the rectum becomes patulous, and you can see as far as the sigmoid flexure perfectly distinctly." This mode of examination he tells us was suggested to him by Dr. Marion Sims. ('On Diseases of the Rectum,' 1871.)

The speculum represented in fig. 244, as made for me by Krohne, is the one I like best. With these brief general remarks we must pass on to the special affections.

Fissure and Painful Ulcer of the Anus.

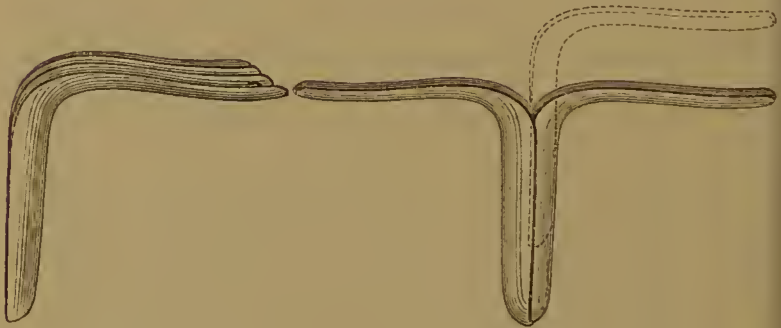
On fissure and painful ulcer of anus.

This is a most distressing affection, and produces more misery than any other local disease with which I am acquainted; it renders the natural act of defæcation an agonising one, often "causing great drops of perspiration to course down the temples." It is usually caused by a mere mechanical splitting of the orifice of the anus, at the junction of the mucous membrane of the bowel with the skin, from the passage of a large or indurated motion, although it is not always traceable to such a cause; in some instances it seems to owe its origin to scratching the parts when highly irritable. It is usually a disease of adult life, and is common to both sexes; it has been found in children, in one so young as a year and a half. ('Brit. Med. Journ.,' June 6th, 1874.) It is found as often in the healthy as in the feeble subject, but it soon tells upon the strongest patient where it has been allowed to go on uncontrolled. Constipation, high feeding, sedentary habits, and want of local cleanliness, are the common causes. Anything that sets up irritation in the intestines is likely to produce it, and when once started, unless treated with discrimination, it may go on for years. It is by no means unusual to hear that the symptoms have been endured for two, four, or even six years. It generally manifests its presence by some local uneasiness in the act of defæcation, this uneasiness passing on to pain more or less severe. This pain as a rule is experienced during the passage of the motion, but in some instances it comes on after the lapse of time, varying from a few minutes to even an hour or more after the act. The pain may last a few minutes or hours, and when it passes away the patient is easy till the same cause excites the same symptoms.

Effects produced by the local disease.

Symptoms.

Fig. 244.



A nest of three. Two adapted for use.

If the motions be examined when an ulcer exists, they will often be streaked with a line of pus or blood, and the size of the motion will always be diminished, sometimes being flattened, at others pipe-like, and this diminution in size is produced by the spasm of the sphincter.

Local signs.

On examining the anus under these circumstances, the first thing that will strike the observant Surgeon is the unnatural resistance the patient makes on separating the buttocks; and on doing this the powerful contraction of the sphincter that will be visible. On attempting to introduce the finger, much resistance will be met with, and should the Surgeon persevere in his attempt, the greatest pain will be caused.

The symptoms of the affection and the local signs already given are, however, as a rule ample to excite in the Surgeon's mind a suspicion as to the nature of the case, and render it unnecessary to make a digital *internal* examination, until he is prepared surgically to treat the case.

External examination.

Situation and size of ulcer.

Indeed, a careful *external* examination will often reveal the presence of an ulcer on the verge of or within the sphincter; when within, its outer border will be visible. The ulcer is usually placed at the posterior margin of the anus, but not invariably; it is rarely larger than a sixpence, seldom so large; when recent, it will be soft, with slightly elevated edges; when of long-standing, indurated with an irregular surface, small polypoid growths fringing its border. The ulcers are at times multiple, in exceptional cases involving the bowel higher up. It is an affection of the mucous and submucous tissue; it is painful only from its position, and obstinate in healing from its connection with the sphincter ani. Simple fissures of the anus rarely involve other than the mucous membrane and skin around the parts; they are often associated with piles, and occasionally with small polypi. Ulcers are often hidden from view when piles or folds of skin about the anus exist, but pain indicates their presence.

In women this affliction is so often associated with reflected uterine symptoms, that it is overlooked, and in men urinary irritation may mask the disease. Reflected nerve pains down the leg, as in sciatica, or in the loins, as in lumbago, &c., are often induced by the affection.

Treatment in simple fissures.

TREATMENT.—Happily for our patients, the treatment of this disease is as successful as it is simple. *Simple fissures* are readily treated by the administration of a laxative, the local application of the nitrate of silver, or of lead lotion mixed with the extract of opium, and local cleanliness, simple nutritious but unstimulating diet being given. At times, when the parts are indolent or syphilis is suspected, black wash is a useful application, or calomel dusted over the part, or in an ointment, five grains to a drachm of lard, or the application of mercurial ointment with the extract of belladonna. Injections of the decoction of rhatany are sometimes of great use.

In ulcerations.

Division of the ulcer and fibres of sphincter.

When a larger *ulcer exists*, and is the cause of spasm and pain, and is quite recent, the same treatment may be employed; but it is quite exceptional for a cure to take place by these means when the ulcer has existed for any time and has a hard base; indeed, the Surgeon is hardly justified in making the attempt when he has at hand such an efficient means as *the division of the base of the ulcer with the superficial fibres of the external sphincter.* In many cases this can readily be done by the introduction of the finger with a probe-pointed bistoury pressed flat upon it till the point reaches the upper margin of the ulcer, when the edge may be turned towards its surface, and its base divided. Boyer, who first suggested the principle of treatment, advised the free division of the sphincter, but Copland and Brodie introduced the minor operation, and it is in the bulk of cases sufficient to effect a cure. In exceptional instances Boyer's operation may be demanded. When chloroform is given, a speculum may be used, and the ulcer exposed. Under such circumstances a sharp bistoury may be passed

Mode of performing.

beneath the base of the ulcer, transfixing the tissues and cutting inwards ; Syme advocated this method. The essential point of practice to observe is the free division of the base of the ulcer down to healthy tissue; the mode of doing it is unimportant. When any fold of skin or pile exists near the ulcer, it should be removed. The *forcible dilatation* of the sphincter, and its laceration with the thumbs in the rectum, as practised abroad, is a barbarous treatment compared with the above. W. Van Buren, of New York, however, advocates it.

Forcible dilatation condemned.

After-treatment.

Mistura Olei.

Division of the sphincter as a rule gives immediate relief. In the after-treatment the bowels must be kept slightly loose, and for this purpose nothing equals in value a mixture of one ounce of olive oil, rubbed down with forty-five grains of carbonate of potash, and mixed with seven ounces of peppermint water, one ounce being given two or three times a day to produce a soft evacuation; some spirits of chloroform may be added when necessary. Indeed, before the operation as well as after, this mixture should be employed; when this fails, enemata ought to be used. The diet should be simple, and rest observed till the cure is complete, for where this rule has not been observed, I have known the ulcer become so indolent as to require a second division, which under other circumstances is rarely called for. Tonics are often of value during the convalescing period.

Spasm of sphincter.

Spasm of the sphincter is only a symptom, it is not a disease ; it is due to reflected irritation from some local rectal, uterine or other affection. It may be due to some small or superficial ulcer beyond the verge of the anus, the presence of worms, or other cause of irritation of the mucous membrane lining the bowel, or to the existence of a small polypus, but a cause will be found by careful investigation.

Neuralgia of rectum.

The same remarks are likewise applicable to *neuralgia of the rectum*, although it is quite reasonable to believe that a pure neuralgia of this part may occur as of any other. Still, as a rule it is caused by reflected irritation from some nerve with which the part is connected, and the Surgeon should clinically so regard it. It is said to be common in gouty subjects, and it is certainly relieved by free purgation.

Dr. Ringer, an able Surgeon in the Indian army, has related to me several cases of this complaint clearly caused by malaria, and cured by large doses of quinine.

Anal Abscess and Fistula in Ano.

Anal abscess and fistula in ano, considered together.

The two subjects of anal abscess and fistula in ano are classed together, as the latter disease is almost always preceded by the former, although it is equally true that a large number of cases of anal abscess get well without passing into a fistula. Out of my notes of 236 consecutive cases of the two diseases, 43 commenced and ended as anal abscess, the remaining 193 being treated as fistula in ano; 74 of these cases were in females, and 162 in males, men being evidently more liable to this affection than women. I have treated a case in a male child four months old, and a second in one of fifteen months; in the latter the fœtor of the discharge was very great; both recovered.

Causes.

Of the causes of this disease little positive information can be given. The abscess, in the majority of cases, begins without any evident cause, and careful questioning generally fails in obtaining definite information upon the point. As a rule, the abscess is obscure in its origin and slow in its progress as in its repair; some patients even profess to have been quite unconscious of its existence till it was about to burst. In other cases they are very *acute* in their action, and very painful.

Not always dependent on ulceration.

That a fistula in ano, and consequently an abscess, must always depend upon and be the result of an ulceration of the bowel within the sphincter is an opinion which can hardly be regarded as true. The fact that there is no evidence to support such an opinion, and that so many instances as forty-three out of the cases quoted of anal abscess should have recovered without forming a fistula, goes far to prove its error; for it can hardly be believed that an anal abscess, the result of a perforated bowel, should recover as soon as an external outlet has been obtained. It is not unfair to infer, therefore, that in many cases it depends upon a different cause.

Fistula generally follows abscess.

In fistula in ano this argument must be equally strong, for it is generally believed that this affection is merely the sequel of the anal abscess; we must, therefore, look for some other and more general cause than that ordinarily received, namely, perforation of the bowel from ulceration.

Mechanical irritation a cause.

The mechanical irritation of a foreign body is doubtless an occasional cause, it being by no means uncommon for a Surgeon to remove from the anus, when opening an abscess, a piece of fish-bone, bristle or other foreign body. Not long ago I removed a pin.

May occur at any period of life.

These affections may occur at any period of life. I have seen a fistula in a child six months old, and have heard of a case that was congenital, the mother having conceived when worrying about her husband, who was suffering from fistula. The case occurred in the practice of Dr. Lipscomb, of St. Albans, who related it to me. In the majority of instances, however, it occurs in adults between twenty and forty years of age. It is very common to be told that the fistula had existed for several years before surgical aid was sought.

Connection between phthisis and fistula.

With respect to the connection between phthisis and fistula, it is difficult to give any positive information. When registrar at Guy's many years ago, I inquired carefully into this point in every case, but I had only 3 cases out of 193 in which either hæmoptysis had been present, or any other symptom of marked phthisis. In the majority of cases the patients presented no more severe cachectic symptoms than exist in any other class of hospital patients, and I confess to being somewhat doubtful as to the fact that fistula in ano is a common consequence of phthisical disease. When associated with it, unless the chest symptoms are very severe, the fistula should be treated in the usual way.

Varieties.
Complete.
Blind external.
Blind internal.

When a fistula has two openings, one externally and the other into the bowel, it is called *complete*. When there is an external but no internal opening to be found, it is known as the *blind external*. When an internal but no external, *blind internal*.

That an internal opening as a rule exists is now scarcely doubted, although at times there may be great difficulty in finding it. M. Ribes in 1819 examined the bodies of seventy-five people who died with fistula, and in all he found an internal opening; in nearly all, this was placed just within the sphincter, but in no instance was it higher than half an inch. Modern Surgeons now accept these facts. The pus that forms in these parts is at times very offensive, as often from the mixture of fæculent matter as from the absorption of fœtid gases through the mucous membrane. In a large number of cases the discharge has no fæcal odour.

Fistula may accompany other diseases.

It should always be remembered that an anal fistula may accompany severe rectal disease, such as stricture or ulceration, or that it may be connected with disease of the pelvic bones, &c. In one case I found that an enormous abscess existed at the base of the bladder, between it and the rectum; it was in an old man. Constitutional symptoms were very severe till two deep incisions were made on either side of the perinæum, giving exit to a quantity of pus; a good recovery ensued. In this instance it was a question whether the prostate gland was in fault, but no symptoms of such a complication could be made out.

Treatment of anal abscess.

TREATMENT.—In cases of anal abscess a *free incision* is the best practice, and this should be made as soon as fluctuation can be felt externally, or through the bowel. Deep-seated abscesses in these regions should not be left to natural processes to open. When the abscess is in front of the anus and rectum, an early opening may be called for, on account of the retention of urine, to which it may give rise. The incision should be made from without inwards, in a line radiating towards the anus. In deep-seated abscesses one or two fingers may be inserted well into the rectum, and the abscess pressed forwards before the incision is made, a sharp straight bistoury being the best instrument to use; a piece of oiled lint should be inserted into the wound, and kept there for a day.

Consequence of not making early opening.

In a case I saw, in 1872, owing to the neglect of making an early opening, emphysema and phlegmonous inflammation of the perinæum, scrotum, penis, abdomen, even up to the axilla, took place, a free communication evidently existing between the bowel and the abscess. The patient died from the constitutional irritation of the disease. The sloughing of the cellular tissue was very extensive and the fœtor of the sloughs something to remember.

After the abscess has been opened, the patient must be kept at rest in the horizontal posture; water dressing applied to the wound, and the most perfect cleanliness observed, laxatives being given when the motions are hard, and also tonics to improve the health.

Treatment of fistula in ano.

When a *fistula exists*, the best operation is its division into the bowel, the action of the sphincter ani having, doubtless, a powerful influence in retarding repair. The bowels should be previously cleared by a mild purge two days before the operation, and an enema may be given on the morning of its performance. The patient should be placed with the fistula upon the side upon which he is lying, with the legs well drawn up, and brought to the edge of the bed or couch, this position being better than that on the elbows and knees, or the stooping over a chair. An assistant should separate the buttocks. The Surgeon should then introduce a fine probe-pointed grooved director into one of the fistulous openings, and with the greatest gentleness guide it through the fistula. Anything like force will excite resistance on the part of the sphincter to its introduction, and cause pain. Should the end of the probe pass into the bowel through the internal opening, all that is wanted has been effected. Should difficulty be experienced in doing this, the well-greased index finger of the opposite hand is to be carefully inserted into the rectum, and the internal opening felt

Operation of dividing a fistula.

for; when found, the end of the probe can readily be guided through it into the bowel. When no internal opening exists (a rare condition), the director must be forced through the bowel at the upper part of the sinus.

As soon as the director is felt in the rectum, the patient should be told to strain, the Surgeon, at the same time, hooking with his index finger its end downwards. By these means, the director will be made to protrude from the anus, and the whole of the tissues bridged over can be readily divided (Fig. 245).

When the fistula runs high up, and when much force is called for to turn the probe out of the anus, it is a better practice to pass a speculum and divide the fistula.

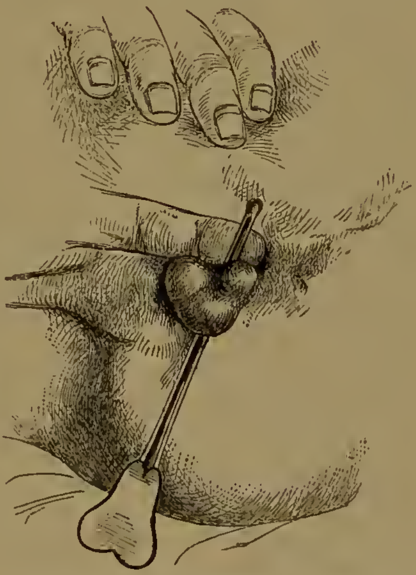
Where there is a long sinus.

When a long sinus runs up by the side of the bowel, it should be laid open through a speculum—to leave it alone is not a safe practice—for, although in some cases a cure may take place, in many the discharge will continue into the rectum, and but little good will have been effected by the external operation. The presence of this internal discharging fistula is generally indicated by the appearance of pus upon the motion.

Where many sinuses.

When many sinuses exist, they should be laid open, although it is not necessary to divide the sphincter in more than one place. A double division of the sphincter is apt to be followed by incontinence.

FIG. 245.



Grooved probe passed through anal fistula before its division.

After-treatment.

After the operation the wound should be well plugged with cotton wool down to the bottom; no careless introduction of the plug into the bowel will suffice. By this measure all bleeding will be controlled, and any amount of pressure may be applied by means of a T bandage.

When no bleeding exists, only a moderate sized plug is needed.

On the second day the dressing may be removed, there being no necessity to introduce a second plug. A piece of oiled wool or lint gently introduced to absorb discharge is all that is required. The wound should be kept clean. When indolent, it may be stimulated by some lotion of nitric or carbolic acid, or tincture of iodine; tonics and good diet are also of value. The horizontal position, not in bed but upon a sofa, must, however, be maintained till the parts have healed.

In the *blind* internal fistula, a guide to the external wound may often be found by means of a bent probe hooked through the internal opening, and the case treated as any other.

When bleeding follows.

When severe bleeding complicates the case, a speculum may be passed, and the vessel seized and twisted. Where this cannot be done, the rectum may be well plugged with a sponge saturated in alum; but, as a rule, a well-applied pad and pressure, adjusted with a T bandage, are sufficient to control it.

A piece of ice put into the centre of a cup-sponge, and applied to the anus, not only arrests bleeding, but gives great comfort in this as in almost all anal operations.

Division by metallic wire and galvanic cautery.

When a cutting operation is inexpedient, as in "bleeders," or when the patient will not submit to it, the division of the fistula with a metallic wire, heated by the galvanic cautery, is a faultless method. Indeed, in all cases of fistula, where the apparatus can be obtained, this means is the best. By it the tissues are divided readily, the two ends of the wire being made to project through the two orifices of the fistula, and burn their way out with a sawing movement; there is little pain at the time, and scarcely any after. There is no loss of blood, and, what is more, no need of any subsequent dressing, for a cauterized surface must heal by granulation.

Treatment by ligature obsolete.

When this plan cannot be followed, the treatment by ligature has been adopted. Mr. Luke revived the practice in 1845, but it has now fairly fallen into desuetude. Were I called upon to adopt the practice, I should use an india-rubber ligature.

Injections.

In rare cases fistula may be treated by injection, a daily injection of the sinus with some tincture of iodine, sulphate of zinc, or nitrate of silver having been followed by a cure; but such cases are too exceptional to justify the recommendation of such treatment.

When operation unadvisable.

When the patient's condition is such as to forbid any hope of repair in the wound taking place, the operation for fistula should be thrown aside; but the existence of pulmonary mischief, if not far advanced, is no argument against its adoption; nay, it may be made use of as an argument in favour of surgical interference, recent investigations, as already alluded to in an early chapter, having indicated that the long existence of suppuration is liable to set up tuberculous disease. Practically, however, it is doubtless true, that fistula may be divided and heal in far from healthy subjects, and that the general health improves after the operation.

Hæmorrhoids or Piles.

On hæmorrhoids or piles.

In a clinical point of view, these may be divided into the "*bleeding*" and the "*non-bleeding*." The *former* are generally the *internal*, and are composed of a highly vascular tissue, involving the mucous membrane of the rectum, and the submucous tissue, with enlarged arteries and veins. Where the arterial element predominates, the tumour has a bright red strawberry aspect; where the venous, a dusky hue; they are closely allied to nævoid structure, and discharge arterial blood.

External piles.

The *non-bleeding* or *external* piles are made up of the loose folds of skin that surround the anus; or a varicose, inflamed or ruptured vein. When inflamed these folds become œdematous and infiltrated with organized inflammatory products, and appear as fleshy growths of various degrees of density. The venous hæmorrhoids also become swollen, and appear as bluish, tense, and painful tumours. When in an active state, they may encroach upon the mucous membrane of the rectum, and appear as large as a walnut, but, as a rule, they are about the size of a nut. They rarely give rise to much annoyance when cleanliness is observed; but, under other circumstances, they cause much local irritation. When swollen or inflamed, however, they give great distress, from the sensitive condition of the skin at these parts. External piles are, however, occasionally the cause of hæmorrhage, the blood at times coming direct from an ulcerated vein, the blood being then venous. At other times it will be profuse, but its exact seat is not so evident. The flow comes from between the pendulous flaps of skin, and ceases when they have been removed.

Treatment of external piles.

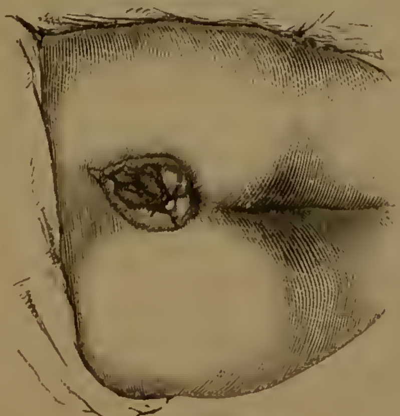
The TREATMENT of these external piles is simple, and excision is the only radical cure. The pendulous flaps of skin that surround the anus may be removed with a pair of sharp scissors, the tumour having been drawn forwards with a pair of forceps. The incisions should be made in lines radiating towards the anus. When coagulated blood has been poured out into the pile and a tense painful tumour exists, it may be punctured or laid open with a lancet, bleeding, when it occurs, being easily arrested by cold and moderate pressure. When the pile is inflamed, leeching often gives comfort, and the application of a poultice, covered with the extract of opium, gives relief. When the part suppurates, the abscess may be opened.

In the early stage of the affection, local cleanliness, the abstinence from highly seasoned food and strong wines are mostly sufficient, the bowels being kept clear by enemata, or the occasional dose of a mild aperient, such as the compound rhubarb pill before dinner, some saline purgative water or electuary. When local irritation exists, an ointment composed of equal parts of zinc, nitrate of mercury, and subacetate of lead is very valuable, some Surgeons recommend the compound gall ointment. An ointment of zinc and the extract of belladonna is very useful.

Internal piles. Character and conditions.

Internal piles are very insidious in their growth; so insidious, indeed, that bleeding is often the first symptom that attracts notice. On inquiry, however, it may generally be made out that constipation has been the normal condition, and that irritation about the anus had previously existed, with a feeling of heat and fulness in the parts. These

FIG. 246.



Internal hæmorrhoids.

piles often appear after parturition. When the parts *inflame*, there will be throbbing, and pain in defæcation; when they *protrude*, there will be one, two, three, or more masses of thickened mucous membrane with nævoid structure, sometimes with a smooth and tense, at other times with a reticulated surface; sometimes there will be oozing of blood from the whole surface, or the blood may spurt from a distinct orifice, the blood being almost always red and arterial, and this mucous projection being surrounded by skin, more or less pendulous, œdematous or infiltrated with inflammatory products (Fig. 246).

When the parts are not inflamed, this hæmorrhoidal mass may protrude only during defæcation, and return naturally or after a little pressure. When the disease has been of long duration, the pile may protrude on the slightest exertion, even on the patient assuming the erect posture, or on coughing, the whole mucous membrane of the rectum often participating in the prolapse, and adding to the discomfort.

Mr. Henry Smith reminds us, that a row of piles may exist within the anus, and a second half an inch or more higher up, and some preparations in the College of Surgeons indicate this condition, proving the necessity of a careful examination of the bowel in all cases before operating.

Pain attending them.

The *pain* attending the development of these piles varies vastly, small hæmorrhoids often giving rise to severe local distress, when larger they cause but little. An inflamed pile is, however, always painful, and a prolapsed, strangulated, inflamed one the most of all. Where pain is excessive, and more particularly after defæcation, there is a strong probability that a *fissure or ulcer* complicates the case.

Hæmorrhage as a symptom.

The amount of *hæmorrhage* bears no proportion to the extent of the disease. In one of the worst cases of hæmorrhage I ever saw, in which a lady was blanched and almost pulseless, the pile was not larger than half a nut; it was of the reticulated kind, and the blood spurted out from a vessel as large as the radial artery. On the removal of the pile, a complete recovery ensued. On the other hand it is remarkable to what an extent the local disease may develop in some cases without producing excessive bleeding.

The bleeding, as a rule, takes place after the action of the bowels, and covers the motion; occasionally it precedes it; but in many instances, it is quite independent of all action of the bowels, blood flowing on the patient assuming the erect posture, or at odd times without any such cause.

Loss of blood may be great.

The amount of blood said to have been lost, under these circumstances, is somewhat remarkable, writers upon these subjects relating the loss of "three chamber-potfuls," "eight or nine pounds," &c. Doubtless, in many of these cases, exaggeration is a common failing; still, all Surgeons must, at times, be astonished at the loss of blood that takes place in these cases daily, sometimes for years, with but little apparent interference with the general health.

Mucous discharge.

The discharge of a thick mucus from the anus is a frequent accompaniment of this affection, and of a muco-purulent secretion when *ulceration* complicates the case.

Urinary irritation.

Urinary irritation, and at times *retention*, in both male and female subjects, often add to the distress, and in women *womb* complications produce the same effect.

Nerve pains.

Nerve pains passing upwards to the loins, hips, and round the sacrum, or even downwards to the heel and sole of the foot, are likewise met with, Brodie having given a case in which the heel pain was the most prominent feature.

Dyspepsia.

What are called dyspeptic symptoms are almost always present, the assimilating organs suffering as well as the circulation and nervous system.

This affection is usually met with after puberty. In early life men are probably more prone to it than women, but after forty-five both appear equally liable.

Constipation.

Constipation has probably an important influence in causing the disease, and certainly in increasing it, but sedentary occupations and high living appear to have a stronger effect. In the prosperous classes of society this malady is said to be a common one, although in the poor, daily hospital experience does not help to confirm the notion that it is rare. Whatever tends to retard the flow of blood from the hæmorrhoidal veins—such as pregnancy and abdominal tumours—aggravates the disease, and whatever tends to keep up irritation in the rectum, such as drastic purgatives, worms, and pungent food, acts in the same way.

May simulate polypus.

A pile may be mistaken for a polypus, but the smooth, firm surface and pedunculated form of the latter will reveal its true nature; again, a ring of piles might be confounded with prolapse of the rectum, but the uniform smooth and generally non-bleeding surface of the latter, with its broad attachments, ought to be enough to prevent the error.

External piles when ulcerated may, however, assume very much the aspect of venereal anal outgrowths, and can be made out only by the history of the case and other clinical symptoms. Finally, it must not be forgotten that hæmorrhoids may be merely a consequence of another disease, such as stricture of the rectum.

Treatment of piles.

Palliative.

TREATMENT.—All piles do not require removal. In the early period of their growth they may be so successfully treated by what is called *palliative* treatment as to render more active measures unnecessary; and in the very cachectic and diseased it may not be expedient to do more than relieve; although it must be added that unless organic disease exists to threaten life, there are few general conditions of a patient that forbid the removal of a severe bleeding pile. Again, when piles occur in plethoric subjects who are, perhaps, what has been described as apoplectic or gouty, when an attack of piles is preceded by constitutional disturbance, and followed by its relief, the Surgeon should be careful in checking suddenly the flow of blood, for such a measure is undoubtedly sometimes followed by alarming constitutional symptoms, but such cases are rare.

Diet.

The *palliative* or *general* treatment of piles means attention to diet; the giving up of high living and the taking of simple nutritious food in moderation, beer and spirits in particular being avoided.

Laxatives.

The bowels must be regulated by the *Mistura Olei* already given (p. 658), castor oil, rhubarb, and magnesia, or saline medicine or water, such as the Vichy, Friedrichshall, or Pullna, and should these fail, by enemata (indeed, the daily enema of cold water or the use of the rectum plug through which cold water is allowed to flow is of great value), all violent purgation, more particularly by aloes and colocynth, being avoided. Some Surgeons give copaiba, but its nauseous qualities forbid its general use. The confections of senna or sulphur are useful medicines, and that of black pepper (Ward's paste) has been always popular. A mixture of confection of senna ℥j, confection of sulphur ℥j, powdered guaiacum ʒij, and treacle, is a very good one.

When the secretions of the liver and intestines are unhealthy, a little blue pill at bed-time or grey powder and chalk are sometimes of use, some bicarbonate of potash in gentian or calumba assisting recovery.

Cleanliness.

Absolute local cleanliness should always be observed, and the recumbent position assumed after defæcation, the prolapsed pile being always reduced at once by gentle pressure. By these different means an attack of piles may pass away never to return, or to do so after a long interval, and even in the worst cases relief may be given.

Reduction of piles.

Leeches when inflamed.

When the piles are inflamed the application of leeches occasionally gives great relief, bleeding being encouraged by hot fomentations; such means are, however, rarely called for, the complete washing out of the lower bowel, rest, and fomentations being as a rule sufficient. In some cases the application of ice in a cup-sponge gives more relief under these circumstances than anything else.

When pile sloughs.

When the prolapsed internal piles are strangulated by the sphincter spasmodically contracting around the mass, sloughing of the whole may take place; under these circumstances great pain is caused by the tension of the parts, and on one occasion I was tempted to cut off with scissors some of the projecting portions, and the relief was so marked that I would do it again under the same circumstances, but to adopt this practice with safety the pile must be in the condition that precedes its death. When this sloughing takes place a cure may follow. During the sloughing process a poultice is the best application.

Enemata and astringents.

The mucous discharge from the bowel in long-existing piles can only be met by enemata and the application of astringents, an ointment of tannic acid, ten grains to the ounce, of gall and opium, or of extract of rhatany, half a drachm to the ounce of lard or spermaceti, being good local applications. The occasional introduction of a suppository of tannic acid into the rectum is likewise a valuable expedient; an enema of alum or tannin, five grains to the ounce, may also be used. Allingham speaks highly of an ointment of the persulphate of iron half a drachm to one drachm of the unguentum cetacei, or, as a lotion, twenty grains to one ounce.

Surgical treatment.

Surgical treatment of piles.

Unless the general condition of the patient forbids, all piles, external or internal, should be removed, when by their presence they not only give local annoyance, but by the hæmorrhage they produce upset the general health of the patient and induce weakness. To do this many means are at our disposal.

External *hæmorrhoids* ought to be removed by abscission.

Internal piles not to be excised.

Internal piles ought never to be excised; they should be destroyed by the galvanic or actual cautery, or ligatured. In the hands of many Surgeons the ligature still holds its ground, but with as many it has been nearly, if not altogether, set aside for the cautery; in a few cases nitric acid is of use. I have only used the ligature in exceptional cases for at least twelve years.

Ligature, and mode of use.

The ligature.—The hæmorrhoidal tumours having been made to protrude by the patient straining over a stool containing hot water, or by an enema of warm water, the patient should be placed on his side with his legs drawn up and the parts well brought into view by an assistant separating the buttocks; the Surgeon should then grasp the base of the tumour that is to be ligatured by a pair of forceps such as that figured (Figs. 247-8), and separate the pile from the skin and submucous tissue by scissors, subsequently transfixing it with a needle armed with a double ligature either of silk or hempen cord. He should then divide the cord and tie the pile tightly in halves, cutting off with scissors half at least of the strangulated portion before finally tightening the second ligature; a second or third mass should be similarly treated, the ends of the ligatures cut off, and the whole may then be returned within the sphincter. The Surgeon should be careful to include in his ligature all the diseased tissue, and when this has not been done with the forceps it is better to pass a needle or tenaculum through the base of the pile higher up, round which the ligature may be looped, than to remove the forceps and reapply it. He should also take care not to include any of the external skin.

Fig. 247.

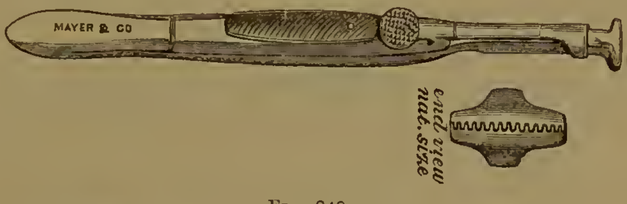
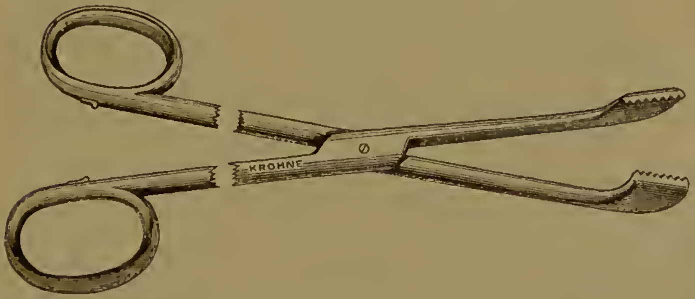


Fig. 248.



The ligatures may be expected to separate about the seventh or tenth day; they should always be allowed to slough off.

After-treatment.

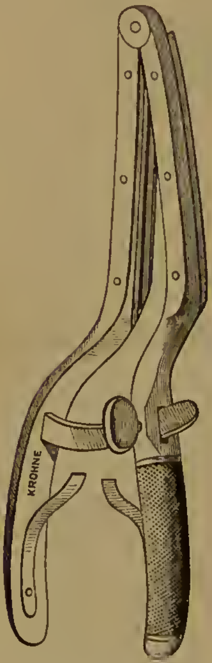
After the operation an opiate may be given or a full dose of chloral (half a drachm). The bowels should be left undisturbed for at least two days, when a dose of castor oil or other purge may be administered, or, better still, an enema; the horizontal position must be maintained throughout the case. Should œdema of the parts follow, ice may be applied, or a lotion of lead and opium, belladonna rubbed down with glycerine at times giving relief. Till the bowels act the diet should be simple, nutritious, but not stimulating. This operation is a successful one, and has no special danger. It is, perhaps, more tedious than the treatment by cautery, and more painful.

Use of cautery.

With the clamp.

The cautery.—When internal piles require removal the clamp and cautery are, without doubt, the best means to employ, and the *galvanic* cautery, when it can be obtained, is far preferable to the *actual.* Cusack, of Dublin, suggested this practice in 1835; but Henry Lee and Henry Smith have done more to establish it than any other Surgeons. It is adopted as follows:—The patient having been prepared as for the ligature, and the piles protruded, each mass is to be seized seriatim with the vulsellum forceps, drawn down and secured at its base by clamps (Fig. 249, a modification of Curling's, being as good as any), the upper end of the clamps presenting towards the anus: the projecting half of each mass is then to be cut off with scissors, the surface wiped dry, and the galvanic cautery, heated to a white heat, applied to the surface; the whole projecting portion being burned down to the level of the clamp, a dense eschar being thus formed. When the galvanic cautery cannot be had, the actual cautery iron is to be used, a second being at hand to use as the first cools.

FIG. 249.



Clamp for hæmorrhoids.

The eschar is more solid and firm after the galvanic than after the actual cautery; it is likewise followed by less pain, the heat being so intense as to destroy all sensibility; ample experience with both has convinced me of this fact.

As each mass is destroyed, the clamp is to be removed, care being taken not to disturb the eschar; when all have been treated, with the finger well greased the whole projecting mass may be returned into the rectum, it being a good plan at this moment to return with it a suppository of morphia to soothe pain.

After-treatment.

The patients should be kept at rest for at least a week after this operation, but they will often be anxious to get up much sooner, saying that they feel quite well; about a fortnight is the average time for convalescence, but a week in good cases seems enough. In one of the worst cases of internal piles I ever treated I applied the clamp to four masses and burned them down as described with the galvanic cautery. After the first day all pain had gone; on the fourth the bowels acted naturally without the slightest inconvenience, and in a week the man was up, no single drawback having taken place. Such a case is, however, exceptionally good even for the cautery.

The after-treatment is the same as in ligature, the local application of ice, perhaps, giving greater comfort.

Cautery without the clamp.

In some few examples of internal hæmorrhoids, where one or two sessile masses alone existed, I have, by means of a speculum, without the aid of a clamp, applied the galvanic cautery to their surfaces direct. Nothing but good results have followed this practice, and I am disposed to think in such cases it is the best to adopt. A good sound eschar forms at once, and on its removal a recovery takes place.

Demarquay ('Gaz. de Paris,' 1860) merely passes a hot iron over the surface of the pile to produce a superficial eschar. He advises also linear écrasement where the piles only protrude on defæcation and can be replaced, where the sphincter is not relaxed, nor the mucous membrane of the rectum prolapsed. In all other cases he prefers the cautery.

Use of nitric acid.

When nitric acid is used, the patient should be prepared and treated in the same way as for the cautery; the nitric acid should be applied with a piece of wood to the diseased surface instead of the hot iron. The spoon-shaped clamp forceps are probably the best to use under these circumstances; after the application of the acid the parts should be well oiled and returned. This practice was suggested by Dr. Houston, of Dublin, in 1857. To small, flat, strawberry-looking internal hæmorrhoids this plan of treatment is very applicable; it is, however, not so satisfactory as that by the galvanic cautery; I rarely now employ it. Ulcerating piles may be treated in the same way as others.

When a fissure or painful ulcer coexists with hæmorrhoids, its base should be divided before the operation for hæmorrhoids is undertaken, or, what is better, lacerated by forcible dilatation of the anus.

Care not to include the skin.

In operating on internal piles the Surgeon must be careful not to take the everted and possibly œdematous skin that encircles the mucous hæmorrhoidal mass for external piles, and remove it. It should on no account be touched. Pendulous external hæmorrhoids may, however, be taken away at the same time.

Propriety of chloroform.

In rectal operations, when an anæsthetic is employed, the patient requires to be brought most completely under its influence, and in this condition the Surgeon loses the valuable aid a patient can give in protruding the hæmorrhoidal mass, and consequently a greater dragging force is necessitated to bring the parts well into view. Upon the whole, however, as large operations are painful and somewhat tedious, it is probably advisable to use the drug.

Local anæsthesia useless.

Local anæsthesia in these operations is worse than a delusion, except for the removal of external piles, but it is good to assist their reduction when inflamed and œdematous, and also to give relief after operation.

Prognosis of the operative measures.

With respect to the danger of operating, it is but small; fatal cases have followed both the ligature and cautery, and the advocates of the latter say it is safer than the former. Mr. Henry Smith, who has operated by the actual cautery in 400 cases, has had only four deaths. It has never fallen to my lot to lose a patient after the adoption of either practice, and upon the whole the operation for piles is a most satisfactory one, and contains no greater element of danger than any other.

Prolapsus Recti.

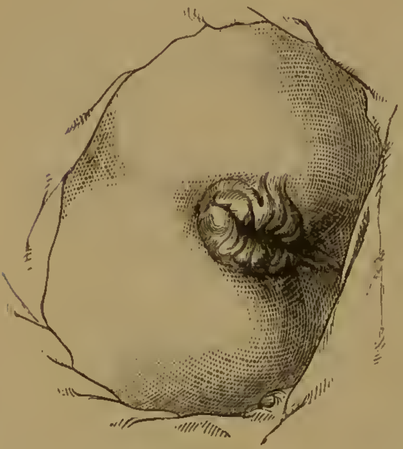
Prolapsus recti.

This is met with in every degree of severity, from the mere protrusion of a ring of *mucous membrane* through the anus (Fig. 250) to the prolapse of even a foot of *entire bowel*. In children a mild form of the malady is very common; but it is usually a symptom either of some urinary irritation, such as a stone, or that caused by a long or adherent prepuce; worms, constipation, dysentery, a polypus, or any rectal irritation may likewise induce it, as may a cough in very feeble subjects, where the sphincter has lost its tone. One of the worst cases I have ever seen in an adult was due to the existence of a villous polypus high

Causes.

up the rectum, the straining accompanying the affection, and the hæmorrhage were very severe, but a rapid recovery ensued on the removal of the growth. In another case, that of a lady where the bowel had come down for sixteen years, accompanied with daily hæmorrhage, and in which walking was rendered impossible from the extent of prolapse—some six inches of bowel—the removal of the mucous membrane in three portions by clamp and cautery rapidly effected a cure.

Fig. 250.



Prolapsus recti.

To find out the true cause of the affection is, consequently, the first aim of the Surgeon, the treatment being then comparatively simple. On the removal of the cause the prolapse rapidly disappears.

Treatment of prolapsed bowel.

Reduction.

Scarification

Nitrate of silver.

Astringents.

Treatment.—Whenever the bowel comes down it should be returned, and this can usually be readily effected by placing the patient in the recumbent posture, and pressing with oiled fingers flat upon the part. In children the utmost gentleness should be employed, for with pain resistance is produced, and with it increased difficulty in reduction. Under all circumstances the patient should be kept in the recumbent posture. The bowels should be relieved in children lying down, and in adults the horizontal posture should always be assumed after natural relief. Brodie advised nocturnal relief of the bowels to be encouraged with this view. When the parts have been down for some time, the greatest trouble is often experienced in their reduction, indeed, sometimes it is impossible; although, with the patient under chloroform, success may attend the gentlest efforts when forcible attempts had previously failed. When the bowel has been reduced, a good pad, fastened on with a T bandage, will keep it in place, or the nates may be fastened together with some good bands of strapping. When the bowel is inflamed or ulcerated—conditions that soon occur in chronic cases when the patient goes about—some slight scarification may be called for; but the application of cold in the form of ice is probably the best treatment. In some obstinate cases in children the free application of the nitrate of silver in stick to the whole mucous surface, wiped previously with lint and mopped subsequently, is often followed by its reduction and retention. I have never seen this practice do harm; one application, at times, cures the disease. The injection of three or four ounces of water made astringent with tannic acid, in the proportion of three grains to the ounce; or with tincture of iron ten drops to the ounce; or of the infusion of krameria, or decoction of oak bark, with or without alum, after the bowels have been relieved, is a valuable adjunct; in adults the tannic acid suppository twice a day is useful, and also the application of the tannic acid glycerine before its reduction. A mixture of the solution of the perchloride of iron with two of glycerine is likewise a good application. Costiveness should never be allowed, enemata being used to keep the bowels empty, or the mildest laxatives, as rhubarb, castor oil, or some natural saline waters—as the Pullna or Friedrichshall. To give the bowel tone, tonics are, as a rule, required, nux vomica being probably the best drug, either alone or in combination with iron. In children, I have never employed this drug, though some Surgeons speak highly of it, but the simpler tonics usually suffice. In children, as an alterative, the rhubarb, soda, and calumba mixture is to be recommended. In more severe cases of prolapse the application of nitric acid in vertical stripes is a very valuable treatment, or, what is better, the galvanic cautery similarly applied. In bad cases it may be necessary to remove three or four vertical folds of mucous membrane with the clamp and cautery, as if for piles. Copeland suggested the practice, although he removed the mucous membrane by means of the ligature; Brodie improved upon it by adopting nitric acid; and modern Surgeons have still further simplified the treatment by introducing the clamp and cautery, galvanic or actual. Few operations in surgery are more successful than this, and although in children it is probably never called for, in adults it should never be rejected, except for the same causes as operations for hæmorrhoids. In very extreme cases of prolapse the linear cauterisation of the prolapsed bowel may be advantageously employed.

Tonics.

Nitric acid.

Removal of folds.

The treatment of such a case would be precisely similar to that laid down in the last section for piles.

Polypus of the Rectum.

This is not so rare a disease as authors would lead us to believe. In the adult it probably is a rare affection, but in the child it is *the principal cause of hæmorrhage from the bowel,* and from this fact cases of polypus have been doubtless put down as cases of piles. These growths are generally found in children under ten years of age. In hospital practice they are mostly seen in the out-patient department. They appear to be more common in male than female subjects, for out of the last eighteen cases I have analysed from my note-book, fourteen were males, thirteen were in children under ten, and five in adults. They vary in size from that of a pea to a large cherry. They grow from the submucous tissue, and are covered by the mucous membrane; when far beyond the reach of the sphincter, and small, they probably do not cause any inconvenience, although when large they may give rise to straining of the bowel, prolapsus recti, and even intussusception. One of the worst examples of prolapsus recti that I have been called upon to treat was due to the presence of a fibrous polypus situated some inches up the bowel; it was in a man 50 years of age, who had suffered from it for twenty years. He was cured by the removal of the growth. Mr. Pollock ('Holmes' Syst.,' vol. iv, ed. 2) has given a case in which intussusception took place, and in another I have to relate the same result ensued. As they near the sphincter local irritation is produced and hæmorrhage, the growth appearing often at the anus as a pink or red cherry. Blood sometimes flows from the anus only during defæcation, at other times independently of it. When the polypus is low down there is usually with the blood a free discharge of mucus.

Polypus of the rectum. More frequent in children.

Size.

Attended with bleeding.

Mode of examination.

Whenever a child is brought with these symptoms a local examination should be made, and to do it efficiently the Surgeon should sweep his finger completely round the walls of the bowel, having passed it well into the rectum. By doing this the polypus will be dragged from its attachment and its pedicle made tense. Sometimes several polypi exist together. I have on one occasion removed three.

Structure.

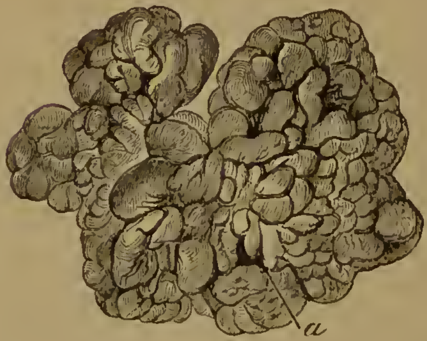
They are made up of fibro-cellular tissue, being more or less fibrous according to the age of the patient; in the adult the fibrous element predominates.

To be removed by ligature.

Whenever a polypus has been discovered, its removal is the only correct practice. In children, when I detect them with the finger, I generally manage to hook them down, and in doing so they often break off. I have never seen any bleeding follow this measure. On several occasions, when I have brought the growth external to the sphincter, the action of the muscle has broken it away, and in this manner many cases of polypi are naturally cured. When they do not break off, a ligature may be applied to the pedicle, but it is well to cut off the growth after its application beyond the knot. In adults the ligature should always be employed.

On the removal of the disease the symptoms disappear; should they continue, a second polypus will generally be found.

Fig. 251.



Villous polypus of rectum.

Villous growths in rectum.

Example.

Villous growths are occasionally met with in the rectum, as in other parts of the large intestine, and when they are low down they give rise to violent straining and hæmorrhage. This straining may, indeed, give rise to an intussusception of the bowel, and when of the sigmoid flexure to prolapsus recti. This was well exemplified in the case of a woman, æt. 43, whom I had under my care in June, 1867. She had suffered from prolapsus recti after every motion for twenty years, with more or less bleeding, the straining at times being most distressing. When I saw her the bowel was down for about nine inches; blood was then passing, and pain was great. I made a careful examination, but failed to find anything; I reduced the prolapsus, and prescribed rest. On my second visit, with the bowel only down a very little, I examined her again, and with my finger could just touch a new growth. With a pair of long forceps I took hold of it and brought it down, finding a splendid specimen of the villous polypus. I put a ligature round its base at once, and cut off the growth. No single unfavorable symptom had to be recorded subsequently; all her former troubles at once disappeared, and a complete recovery ensued. In June, 1870, this woman was still well. The growth is illustrated in Fig. 251, with the microscopical appearances (Fig. 252), and Dr. Moxon's report.

Condylomata.

Condylomata are also very common about the anus; they are mostly syphilitic, but not always, the irritation of dirt being probably sufficient to produce them; in children they seem to come from the irritation of worms.

Fig. 252.

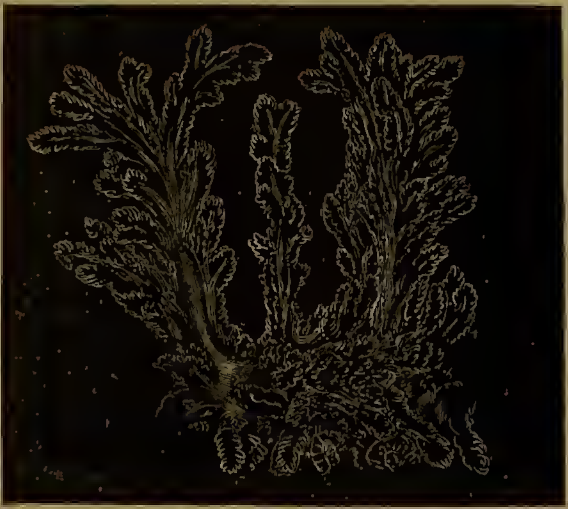


Fig. 251.—Polypus.

Fig. 252.—Vertical section of the growth through the line *a*, fig. 251, showing vascular simple and compound villi, covered with a columnar epithelium; large vessels in the base on which the villi rest; and sections of the follicles of Lieberkühn. This section represents half the thickness of a lobule of the polypus seen by 1½-inch power.

Dr. Moxon's Report on Villous Growth, with drawings.

Treatment.

Cleanliness, the application of nitrate of silver, and the dusting of their surfaces with calomel or oxide of zinc, generally produce a rapid cure. *Vegetations* due to the irritation of acrid discharges, such as *gonorrhœa* or *syphilis*, require to be excised.

Warty growths.

Warty growths are also met with about the anus, as about other cutaneous surfaces. Sometimes they grow to a great extent, and then excision is the best practice. I have removed a mass the size of a fist.

Pruritus ani.

Pruritus ani should generally be looked upon as a symptom of some rectal or intestinal irritation, constipation, or rectal disease. It is always a source of great distress, the most distressing cases being those in which the symptoms occur at night in bed, preventing sleep. The best application I know for its relief is a cold sponge, and, having dried the parts, the unguentum metallorum, made of equal parts of zinc, nitrate of mercury, and subacetate of lead ointments. Some Surgeons recommend a lotion of the nitrate of silver, ten to fifteen grains to the ounce; the zinc and opium ointment is also good. The application of cold through the rectum plug may also be recommended. These remedies, however, only relieve the symptom; for a cure the cause must be found out and remedied.

Ulceration of the Rectum and Stricture.

Ulceration of rectum.

The painful ulcer of the anus, or anal orifice of the rectum, has been already noticed, and it remains for us to consider briefly such other forms of ulceration of the rectum as are met with in practice. They may be described as *simple*, *syphilitic*, and *cancerous*. *Simple* ulceration is by no means infrequent, and when not involving the anus, it gives rise to symptoms which are usually looked upon as dysenteric.

Symptoms of ulcer of rectum.

The passage of lumpy fæces with blood and muco-purulent discharge are the chief symptoms. The rapid passage of the intestinal contents through the sigmoid flexure and rectum gives rise to a slight griping pain, but beyond this there are few general symptoms. On examining a rectum, under these circumstances, a single ulcer will probably be found, but occasionally more. It may be somewhat indurated at its edges, but its base is not so as a whole. It is often circular, and at times surrounding half the rectum. In the case of a boy, æt. 16, under my treatment, the surface of the ulcer was so nodular that I should have suspected its cancerous nature had I met with it in an adult, but in this instance it had existed for many months, and the granulations had assumed a polypoid nature. It ended in a recovery. These simple ulcers are also prone to perforate the bladder, and induce recto-vesical fistula. I have had five such cases, and in four colotomy was performed with success, the operation taking away the chief source of distress—the passage of fæces with the urine—prolonging life, and apparently allowing the ulcers to heal. (*Vide* paper by author, 'Clinical Soc.,' 1872.)

Prone to form fistula.

Treatment of ulcers.

These cases are to be *treated* by general means, such as a careful regulation of the diet, alkaline medicines with tonics, the administration of laxatives such as the mistura olei to cause and maintain a soft condition of the fæces, and the daily administration of a small two-ounce enema of starch and opium, or simple oil, the recumbent position being maintained as much as possible.

Under these circumstances a good recovery generally takes place.

When these ulcers involve the anus, they give rise to the same painful symptoms as the painful ulcer of the anus, and must be treated in the same way by division of the superficial fibres of the sphincter.

Syphilitic disease of rectum.

Syphilitic disease of the rectum is a more common affection. It is met with in both sexes, but more frequently in women than in men, the disease apparently creeping from the vagina to the rectum, although occasionally it is doubtless due to direct contact of the poison. It appears as a more or less extensive ulceration of the lower two inches of the rectum; it, as a rule, involves the anus, and may pass higher up the rectum. It is a disease of the mucous and submucous tissue, and is indicated in its early stage by a spongy induration of these tissues, and later by ulceration and the discharge of a highly irritating sero-purulent or sanguineous discharge and by a patulous anus. The anus itself may also be the seat of the lateral, flattened, fleshy, cutaneous outgrowth so common in syphilis, or it may be ulcerated. It is generally a disease of young adult life, and is associated with some syphilitic history. There is almost always some pain in the act of defæcation, some looseness of the bowels, and discharge of blood, pus, or mucus. Anal or vaginal fistulæ sometimes complicate the case. In neglected cases, where cicatrization has gone on with spreading ulceration, there may be constipation and some stricture; indeed, as a cause of stricture of the rectum, this syphilitic disease is by no means unusual.

Symptoms.

Treatment of syphilitic disease of rectum.

TREATMENT.—Recognising its syphilitic origin, large doses of the iodide of potassium ought to be given, five grains three times a day, gradually increased to ten or twenty, in some bitter infusion or bark; when tonics are indicated they may be given in combination. The bowels should be kept slightly loose by the daily dose of olive oil or castor oil, so regulated as not to purge, and the daily employment of an enema of starch or gruel, with or without oil, to keep the parts clean and free from the irritation of fæces.

The recumbent posture should likewise be observed, and simple, nutritious, but not bulky, food taken.

Local measures.

Locally, absolute cleanliness is essential; where contraction exists or is taking place, the daily introduction of a bougie anointed with some mild mercurial ointment, such as the unguentum metallorum, may be used; but for the patient, the daily introduction of a candle similarly anointed is far preferable, candles being made of all sizes. Nothing like mechanical dilatation should be thought of. By these means a cure may be effected, but it can only be after the treatment of months. In very neglected or severe cases a cure is almost hopeless without colotomy. I have had some striking examples under care well illustrating the advantages of this operation. The recognition of the disease as a syphilitic one is the main point to be made out.

Foreign authors describe *chancroid* disease of the rectum, venereal but not syphilitic; in this country it is hardly recognised. Such cases may, however, be found amongst those described as cases of simple ulceration.

Cancerous ulceration of rectum.

Symptoms.

Cancerous ulceration of the rectum, usually epithelial, sometimes villous, rarely carcinomatous, is generally met with two or three inches up the bowel. It is occasionally seen higher up and beyond the reach of the finger, in the rectum, and occasionally lower down nearer the anus or involving it. It is remarkably insidious in its origin, and uncertain in its progress, giving rise at first only to such symptoms as are usually put down to constipation, for this symptom is the most prominent one, and the occasional pain and bearing down or straining are looked upon as the result of the constipation. In a general way, indeed, it is only when some blood or sero-purulent fluid has passed, with or without a motion, that surgical aid is sought, and it is under such circumstances that the Surgeon discovers, on making a local examination, that such a serious disease exists.

Characters.

Case.

The cancerous ulcer can rarely be overlooked; it occurs as an indurated, nodular, irregular mass; in its early stage with a smooth surface, in a later with ulceration, the discharge, which is generally very offensive, being made up of broken-up tissue, blood, and thin pus. It, as a rule, involves the whole circumference of the bowel, at times only a part. It is always associated with some narrowing of the canal, and this will go on to cause its complete occlusion. In September, 1871, I attended with Mr. Turner, of Bermoudsey, a girl, æt. 18, who had had insuperable constipation for seven weeks. I opened her colon in the *right* loin with great relief, for she was up and about in six weeks. She died ten months after the operation (June, 1872), with a rectum *completely occluded* from cancerous disease, and with secondary tubercles in the pelvic peritoneum. The disease was examined by the Committee on Morbid Growths at the Pathological Society, and was reported on by Dr. Hilton Fagge and Dr. Goodhart. They found it to be of a cancerous nature, confined to the peritoneum and ovary, and only leading to stricture of the bowel by a secondary process of contraction. The stricture had an ulcerated surface, but the mucous membrane did not show any cancerous elements. ('Trans. Path. Soc.,' 1875.) The symptoms, indeed, are those of stricture.

Treatment of cancer of rectum.

TREATMENT.—Palliative treatment can alone be thought of, such as the maintenance and improvement of the general health by diet and tonics; the removal of all local causes of irritation by the use of laxatives to render the motions more liquid and consequently more easy for evacuation; and the relief of pain by the use of enemata of starch and opium or morphia suppositories.

In the very early stage of the affection, before ulceration has taken place, the use of bougies may be justifiable and useful, but when ulceration exists they are worse than useless, they are injurious and dangerous. When the obstruction becomes a symptom of importance, surgical treatment will have to be thought of; this will be considered under the heading of stricture of the bowel.

Complications of ulceration.

Complications of ulceration.

Stricture as a result.

All cases of ulceration of the rectum may go on to cause stricture; the cancerous cases to a certainty will, the syphilitic often do, and the simple may when extensive. The two latter cause a *cicatricial* stricture, resulting from the contraction of the cicatricial tissue in the mucous and submucous tissue; the first produces a stricture by simple increment. They may likewise all be complicated with deep-seated abscesses and fistula, and also with hæmorrhoids; the Surgeon should therefore always be careful when treating cases of these affections to examine the rectum minutely, for it is only too common to meet with cases that have been subjected to useless operations for piles and fistula, when these affections were the results of a far more serious disease, such as stricture or ulceration of the rectum.

Abscess and fistula; hæmorrhoids.

Ulceration into bladder.

Again, any of these forms of ulceration may extend into the bladder or urethra. I have had five examples of such cases of vesico-intestinal fistula under my care in males, and one case in a female, in all of which the agonies of a foreign body in the bladder were added to those produced by the ulceration, and in the four male cases complete relief was afforded by colotomy. In three of these cases the ulceration seemed to be of the simple kind. In another case the existence of rectal ulceration was first revealed by a sudden rush of urine through the rectum after an attack of retention.

Ulceration into vagina.

I have seen many cases of recto-vaginal fistula as a consequence of syphilitic and cancerous disease.

Stricture of the Rectum.

On stricture of the rectum.

Causes.

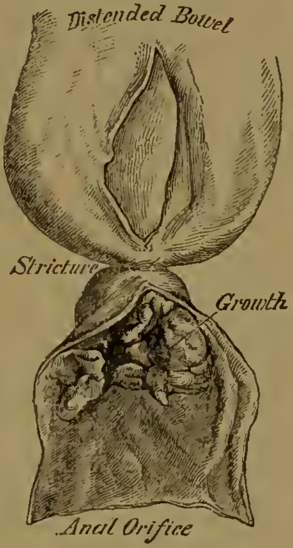
In the majority of cases this is caused by cancerous disease, in many it is the result of an inflammatory process, simple or syphilitic, from the cicatrization of deep-seated and extensive ulceration; in others it is due to the contraction of inflammatory material poured out external to the bowel in the submucous tissue; in exceptional instances it may be caused by contraction of the parts external to the bowel after pelvic cellulitis, and Curling quotes a case where it was the direct result of an injury.

Condition of parts in cases of stricture.

In all these conditions the calibre of the intestine is gradually or rapidly encroached upon, till at last complete obstruction takes place. The stricture may appear after death as an *annular* contraction of the bowel, with adventitious material in the submucous tissue and hypertrophy of the muscular coat, looking very like a so-called scirrhous pylorus; or as a thickened, ulcerated, irregular mass of cancerous material, infiltrating all the tissues of the bowel, although rarely extending beyond two or three inches in length. The bowel above the stricture will always be dilated, at times even to its rupture, ulceration of the colon being a very common consequence of the dilatation. Below the stricture there will often be found pedunculated, fleshy, or cancerous growths. These points are well seen in Fig. 253.

It has been already pointed out that fistula,—ischio-rectal, vesical, or vaginal,—abscesses and hæmorrhoids, are common accompaniments of stricture.

Fig. 253.



Stricture of rectum.
3255^{0}, Guy's Hosp. Mus.

Statistics.

The disease, taken as a whole, is twice as common in women as in men, and I find from my own notes that thirty-two out of forty-eight consecutive cases were of the former sex. But syphilitic stricture is more common in the female, and cancerous stricture in the male.

Curling's statistics.

Curling, in quoting 67 cases of cancer, gives 44 in males; and in my 48 cases 20 were found in subjects under thirty, 15 of these being women, and mostly, if not all, syphilitic; 22 were in subjects over forty, half being men, the majority of these being probably cancerous.

Symptoms of stricture.

The approach of the disease is very insidious, whatever may be its origin or nature, and the symptoms are generally such as have been given under the heading of cancerous ulceration of the bowel.

Constipation.

Constipation is the one early symptom, and it is not till some ulceration has commenced, either at the stricture or above it, that others appear, such as *diarrhœa*, with lumpy stools, containing blood, pus, or mucus, *straining* at stool, and a *sensation of burning* in the part afterwards, with at least a complete stoppage, abdominal distension and dyspeptic symptoms.

Local examination.

An examination with the finger carefully introduced into the rectum will, as a rule, at once reveal the true nature of the case, for about two inches up the bowel the narrowing will usually be felt, with or without new tissue infiltrating the part, or ulceration. In exceptional cases the stricture is beyond the reach of the finger. Under these circumstances, however, it may at times be brought within reach by pressing with the free hand upon the abdomen above the pelvis or by the introduction of the hand into the rectum.

When the stricture is an *annular* one, it is probably cicatricial, or fibrous, possibly cancerous.

When *epithelial* or positively cancerous, the seat of stricture will be infiltrated with a nodular, irregular mass of new tissue, probably breaking down and ulcerating. Sometimes this mass can be felt externally at the brim of the pelvis over the left iliac fossa. I have felt this clearly on many occasions.

When *syphilitic*, the ulceration will probably extend upwards from the anus, and the anal integumental outgrowths, already mentioned, will exist.

In ordinary cases of cancerous stricture there is an inch of healthy rectum between the stricture and the anus; in exceptional and very extensive disease the anus is involved.

In advanced cases the anus will appear patulous, and on separating the buttocks a red, brick-dust coloured, fæculent discharge may run out; wind will also pass without effort.

Flat, tape-like fæces.

To flat, tape-like, or figured fæces, as given by authors as characteristic of this disease, I, with Curling, do not ascribe much importance, for such a condition of motion is very usual, even in a state of health, when the bowels are irritable, and many other conditions of the pelvic parts may give rise to the same thing; but when a patient never passes a well-formed motion, large or small, the case looks suspicious. On the other hand, when a large well-formed stool is occasionally seen, the probabilities of a stricture existing are very slight.

Caution in use of speculum.

The examination of a rectum, the subject of disease, with a tube, flexible or otherwise, requires the greatest care and gentleness. The Surgeon may be misled by various things, such as the end of the instrument striking against the sacrum, or being caught in a fold of mucous membrane, thus inducing him to suspect obstruction where none exists. But "if some warm fluid, as linseed tea, be injected somewhat forcibly through the tube, a space is formed admitting the easy transit of the instrument. In stricture pain is felt when an instrument reaches the point of contraction, and a flexible one is arrested or passed on with more or less difficulty." (Curling 'On the Rectum,' 1863.)

Symptoms of stricture may be due to presence of tumour.

The Surgeon must also remember, in examining a rectum for a supposed stricture, that its calibre may be more or less completely encroached upon by pelvic tumours, uterine, ovarian, prostatic, hydatid, or bony. Some few years ago I had a case with Dr. De'Ath, of Buckingham, in which an hydatid tumour caused complete obstruction to the rectum as well as to the bladder, and although the latter organ was emptied on the evacuation of the hydatid contents, the patient died unrelieved from an enormously over-distended and ruptured colon ('Trans. Path. Society,' 1866), and in April, 1870, I saw, with Mr. Phillips, of Leinster Square, a most interesting case of complete obstruction of the bowels in a lady, æt. 46, caused by the presence of a large, loose, cancerous growth hanging into the pelvis from the peritoneum, covering in the promontory of the sacrum. The tumour had been regarded by an eminent physician accoucheur as uterine. Colotomy was performed with great relief, but death took place from collapse on the third day from a sudden rupture of the tumour and escape of its softened contents into the peritoneal cavity. In March, 1875, I opened the descending colon of a boy, æt. 18, for complete obstruction of the rectum from a cancerous tumour that filled the pelvis and the abdomen as high as the umbilicus. The boy survived the operation two months, dying from other causes than obstruction.

Treatment of stricture of the rectum.

Treatment.—It is so rare for a Surgeon to be consulted about a stricture of the rectum till the ulcerative stage has set in, or nearly complete obstruction has taken place, that he has few opportunities of testing the value of dilatation of the stricture; for although this practice is clearly useless, if not injurious, when ulceration exists, it is probably of great value before any breach of surface has taken place. In cicatricial or inflammatory strictures, indeed, it is the only form of practice upon which reliance is to be placed, but in the cancerous, whether in the ulcerating stage or not, it is not wise to make the attempt.

Dilatation.

This dilatation is to be effected by mechanical means, and many instruments have been invented for the purpose. The elastic-gum bougie, in the hand of the Surgeon, is, however, the best; forcible dilatation is inadmissible. These bougies are made in many sizes, and the one chosen should be just large enough to pass through the stricture. It should be warmed, well greased, guided by the finger passed gently through the stricture, and retained for ten or fifteen minutes at a time. When it does not produce any irritation, a second, larger, may be passed in two days, but when irritation is set up the repetition of the operation should be postponed till it has subsided. By these means a simple stricture may be checked in its progress, and even dilated, but rarely cured; this practice may prolong life for years. Mr. Curling has, however, given a case in his book in which he believes he cured an annular stricture in a lady, æt. 24, by *incisions* and dilatation.

Linear rectotomy.

M. Verneuil, in the 'Gazette Médicale de Paris' for January, 1873, has advocated the operation of "linear rectotomy" for the cure of stricture, meaning by this operation an incision in the median dorsal line of the bowel, through the stricture and entire thickness of the bowel downwards and through the anus, including the sphincter. He gives two cases in which he performed this operation, and apparently with benefit. Dr. F. Lente, of New York, has also advocated a like practice ('American Journ. of Med. Sciences,' July, 1873), adopting, however, an anterior as well as posterior incision in non-malignant strictures.

Enemata.

Caution in use of enema tubes.

This dilatation is, however, only a means to an end, and that end is to secure an opening for the passage of the intestinal contents. Enemata are valuable aids to effect this purpose, the daily washing out of the bowel with gruel and oil giving great relief, or the daily dose of mist. olei with manna, confection of senna with sulphur, or any other gentle laxative that by experience the patient has found to suit. Cod-liver oil in full doses often acts as a laxative as well as a tonic. Care must, however, be observed in the introduction of the tube, for in a cancerous bowel perforation is very prone to occur, and even in a healthy one the same accident has taken place. The Guy's Museum contains a Prep. (1877^{60}), in which the colon was perforated by a bougie thirteen inches from the anus for an imaginary stricture, and a second (1877^{80}), in which an O'Beirne's tube perforated the rectum five inches from the anus in an attempt to pass it up the healthy bowel to give relief in a case of obstruction after the reduction of a hernia.

Question of allowing patient to pass tube.

How far it is safe to allow a patient to pass a bougie for himself or herself is another question. I am disposed to think it is an unwise act to allow when the bougie is solid, for I am sure I have seen great irritation, and consequently harm, follow upon the practice, and in several cases, deep-seated suppuration. Curling has given a case where the patient caused his own death by perforating the bowel half an inch in extent above the stricture. I have consequently been in the habit of instructing my patients to use tallow candles as bougies, and have been well pleased with the practice.

Colotomy, when necessary.

There comes a time, however, when this treatment by dilatation ceases to be beneficial; when the stricture has so closed as to render it useless; or so ulcerated as to render it unwise to adopt the practice; or is associated with so much distress as to forbid its use. Under these circumstances the operation of *Colotomy* is of great value; it gives comfort to a degree that sometimes astonishes, and always gratifies; and on convalescence or recovery it is not found to be practically associated with such inconveniences as Surgeons of old have theoretically attributed to it. It prolongs life, and adds materially to its comfort, and little more than this can be said of most operations. But it must not be postponed till the powers of life have become so exhausted as to render the chances of recovery from the operation poor; or till the large intestine has become so distended as to have become damaged or inflamed. It should be undertaken as soon as it is clear that the disease has passed beyond the reach of local treatment with any prospects of good, and that the general powers of the patient are *beginning* to fail; as soon as the local distress finds no relief from palliative measures, and a downward course is evidently approaching. The difficulties of colotomy are not great, nor are its dangers numerous; when *unsuccessful* it has been usually made so by delay in its performance, from the want of power in the patient, or from the secondary effects of the disease on the abdominal viscera. When *most successful* it gives immediate relief to most of the symptoms, and makes life worth having. When *least* so, by lessening pain it renders what remains of life endurable. The operation must be regarded as established, and creditable to surgical art, although it must be admitted even now that in the general way it is apt to be postponed until too late a period to demonstrate its full value.

Value of operation.

When to be undertaken.

The Operation of Colotomy.

On the operation of colotomy.

For irremediable stricture or mechanical obstruction of the rectum from any cause, *Callisen's* operation of opening the colon in the *left* loin should always be followed, and when the seat of obstruction is higher than the rectum, and it is a point of doubt whether it be in the sigmoid flexure or transverse colon, *Amussat's* operation in the right loin should be performed; for Callisen first suggested colotomy in 1796, and applied it to the descending colon, and Amussat revived the operation and extended it to the ascending colon in 1839.

The colon in this position lies behind the peritoneum, immediately beneath the transversalis fascia. The kidney is in close contact with it above, and in one case upon which I operated, the organ was placed so low down as to fill in the space between the rib and pelvis, and it had to be pushed upwards to allow the colon to be seen and opened. The operation is to be performed as follows, on the left loin:

Mode of performance.

The patient is to be placed upon his right side with a pillow beneath the loin, in order to arch somewhat the left flank, and turned two thirds over on to his face; the outer border of the quadratus lumborum muscle is then to be made out, for this muscle is the Surgeon's main guide. Its outer border with the descending colon is to be found half an inch posterior to the centre of the crest of the ilium, the centre being the point midway between the anterior superior and posterior superior spinous processes. Allingham says that from more than fifty dissections he has always found the descending colon to be so situated. He has never known this point to fail him; when difficulties are felt in the operation, he believes they are from the colon being looked for too far from the spine ('St. Thomas's Hosp. Reports,' 1870). In this opinion I cordially agree. An incision is then to be made four or five inches long, beginning one inch and a half to the left of the spine, below the last rib, and passing downwards and forwards in front of the anterior spine of the crest of the ilium, with the line of the incision passing obliquely across the external border of the quadratus lumborum muscle about its centre, and taking the same direction as the nerves which traverse this part. By this incision the integuments and fascia are to be divided, and the outer border of the quadratus muscle exposed; the abdominal muscles are then to be divided to give room, commencing at the outer edge of the quadratus, and this had better be done upon a director. All vessels are now to be secured. The transversalis fascia will next come into view, and beneath this will be the colon, a layer of fat sometimes intervening; the fascia is to be opened with caution, for in the loose fat and cellular tissue the colon is to be found; when distended, the bowel comes at once under the eye on dividing the fascia, but when empty, some little trouble may be experienced in hooking it up with the finger. I have found, however, on several occasions at this stage of the proceeding great help by rolling the patient over on to his back; the bowel falling by this manœuvre on to the finger, and being then readily caught.

When colon is empty.

When the bowel has been caught it should be partially rolled forwards, in order to expose its posterior surface, for if this be not done there is a risk of the Surgeon wounding the peritoneum where it is reflected from its anterior surface on to the abdominal wall. The bowel having been drawn up to the wound, is then to be secured to the integument, and not to the muscles, by the passage of a ligature introduced through one margin of the wound, then through the bowel, and lastly, through the other margin. The bowel may then be opened by a longitudinal incision about three quarters of an inch long over the ligature that has traversed its canal; the centre of the ligature is then to be drawn out and divided, the two halves of the ligature fixing the two sides of the divided intestine firmly to the margins of the wound; two or four more stitches may then be introduced to make the artificial anus secure. The margins of the wound may be oiled to guard against the irritation of fæces, and the patient placed in bed. At times the fæces escape in large quantities directly the bowel is opened; at other times some slight fæculent discharge will take place at the time, the larger flow taking place later. This is not, however, a point of any importance, and the Surgeon should take no measures to get the bowels to act; indeed, it is better, as far as the operation is concerned, that the flow be postponed, for within an hour or so the parts about the wound become sealed with lymph, and thus the risks of extravasation are diminished.

Care in not wounding the peritoneum.

Passage of ligatures.

Opening of gut.

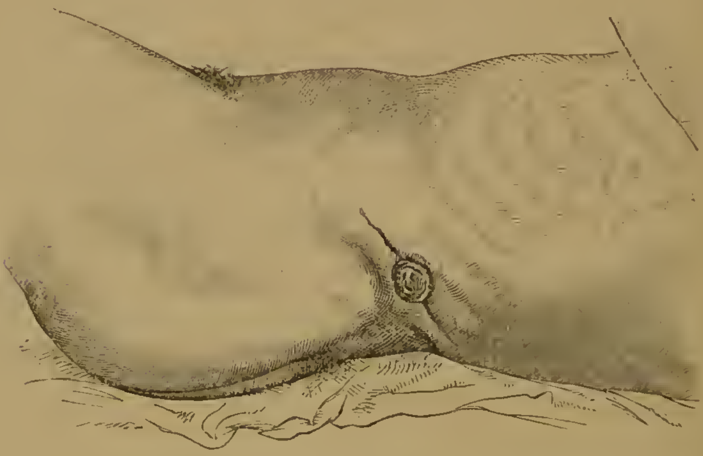
Mode of fixing gut.

Amussat originally suggested the *transverse* incision in the loins, and Callisen the *vertical*, the former one crossing at right angles the outer border of the quadratus lumborum muscle, the latter running parallel with it. The *oblique* appears to me to be far preferable to either; it gives more room for manipulation when the colon is empty, it takes the line of the nerves and vessels that traverse this part, and lessens the risk of their division; it follows the ordinary integumental fold of a patient when assuming the recumbent posture, and thus

Variations in the operation.

favours repair, and seems to tend much towards the prevention of the prolapse of the bowel that is always prone to follow such an operation. Fig. 254 illustrates the line of incision and the appearance of the artificial anus. It was taken from a patient of Sir W. Gull's, æt. 64, that I operated upon in 1869 for vesico-intestinal fistula, and who died five and a half years subsequently (1875) from a ruptured heart. The gentleman followed his avocation without any discomfort.

Fig. 254.



Artificial anus after colotomy with the oblique incision.

After-treatment. After the operation a good sedative should be given, such as opium, morphia, or chloral, and the recumbent position maintained, a piece of oiled lint covered with oakum, and kept in place with a soft towel, being the best application.

Sutures removed on fourth day. The sutures may be removed on the fourth or fifth day, according to circumstances, and the most perfect cleanliness must be observed.

Good food and stimulants may be given within a day or so of the operation, repair, as a rule, going on favourably.

Appliances after cicatrization. When the wound has cicatrized, the patient may get up, and a pad covered by a folded napkin, and fastened on with a lumbar binder, is the best application. The ivory ball or plug, that has been advised, appears to be a useless instrument; it cannot be kept in its place, and does not, therefore, prevent the prolapse of the bowel that is said to be so likely to follow the operation.

Value of the oblique incision. With the oblique incision this prolapse does not appear to be the cause of any annoyance, for it seems to take place to a very slight extent.

Should contraction of the orifice take place to too great an extent, a sponge tent may be daily introduced. Mr. Pollock gives a case where such treatment was a necessity. ('Holmes's Surg.,' 2nd ed., vol. iv.) I have not yet met with one.

Cleansing of the lower bowel. After convalescence it is well occasionally to wash out the lower portion of the bowel with warm water, for some fæces are apt to pass the artificial opening and rest in the rectum, causing irritation. When the anal end is open it is best to do this through the natural opening, when it is closed, through the artificial one.

Prognosis.

I have performed this operation now twenty-seven times: in four for vesico-intestinal fistula, in two for pelvic tumour, and in twenty-one for stricture of the rectum. One of the cases of vesico-intestinal fistula lived four months after the operation, and died with suppurating kidneys, but entirely relieved from all vesical and rectal distress. ('Brit. and For. Rev.,' Jan. 1869.) One lived nearly six years after the operation, and died, æt. 70, from rupture of the heart. The third is now alive, five years after the operation, and enjoying life, suffering very little inconvenience indeed from the artificial anus. ('Clin. Soc.,' 1872.) The patient with pelvic tumour, already noticed, died on the third day from rupture of the tumour. The second was kept alive two months, and died from the disease.

Of the twenty-one patients with stricture, cancerous and otherwise, one lived three years after the operation, and one eighteen months, dying from supposed cancer of the liver after a month's illness, two lived ten months, and two five, six survived the operation from seven to eighteen days, six died within the week, the operation in the majority of these cases having been undertaken as a last resource. Three were alive when last heard of, two having been operated upon two years and one fourteen months ago. In every case marked relief was afforded to symptoms, and in many the patients' expressions of gratitude for such were very strong, several having deeply regretted that the operation had not been performed at an earlier period.

I have in no single case ever regretted performing this operation, although I have in a large number wished that I had had an opportunity of performing it earlier, for in no instance in which I have undertaken it have I failed to give relief.

In one of the cases of colotomy for vesico-intestinal fistula, who is now alive, five years after the operation, urine finds its way, when the patient is recumbent, out of the lumbar artificial anus, and in the second case, that survived the operation nearly six years, the same complication was present. In neither instance, however, was the flow a source of trouble. This flow, however, might have been enough to keep that portion of the intestine that existed between the artificial anus and the bladder patent, and to preserve it from atrophy, for such a result of colotomy is clearly possible, Dr. Michael Harris, of Liverpool, having recorded in the 'Liverpool Hospital Reports' for 1874 the particulars of a post-mortem examination of a case in which Mr. Hakes had performed colotomy five years previously for vesico-intestinal fistula, in which the descending colon from the artificial anus, together with the sigmoid flexure and rectum as far as the bladder, had become *completely obliterated* and was found to be replaced by a cylindrical mass of fat. The length of this fatty column was about six or seven inches, and in the centre of it was found a fibrous cord of about a line in thickness, but no trace of a canal of any kind could be detected in it.

Statistics of the operation.

Curling has performed or recommended the operation in seventeen cases, and in ten the patients survived over periods varying from two to eighteen months. Pollock gives a case where the patient had survived the operation for two and a half years. Allingham has had ten cases: one died within a fortnight of the operation, five lived a few months, one nineteen months, one four and a half years. Two were known to be living, three and four years after the operation.

Operation when advisable.

These results cannot be regarded otherwise than with satisfaction, for it must be remembered that in all these cases the operation was undertaken when life was threatened, and the distress from the local disease was severe and otherwise irremediable. The operation is a good one in all cases of vesico-intestinal fistula, when solid fæces flow with the urine; in all cases of stricture of the rectum, as soon as the obstruction becomes serious and local distress great; in all other cases of mechanical obstruction to the rectum from pelvic causes, when no less severe measures for relief can be suggested; and, last but not least, in extensive ulceration of the rectum, cancerous, syphilitic, or simple, when local treatment fails to give relief, and local distress is great, when the general powers are evidently giving way from the local disease, quite irrespective of all mechanical obstruction.

In no case, however, should the operation be postponed till the patient's powers are failing, for the prospects of recovery are greatly lessened, and convalescence is often rendered improbable.

Atony of the colon and dilatation of the rectum.

Atony of colon. Dilatation of rectum.

These conditions are not rarely met with in practice. In old people, the colon, for want of power, often becomes enormously distended with fæculent matter from gradual accumulation, and this condition is frequently the cause of death. In some cases it gives rise to the idea of stricture of the rectum, and every Surgeon must have been called to cases in which impacted fæces in the rectum and colon, associated with the discharge of small, loose, offensive motions mixed with mucus and sometimes blood, has misled the attendant. Some few years since, I was asked to see a lady over seventy, who had been bedridden for six months, and was supposed to be dying from constipation and stricture of the rectum, nothing but small lumpy and loose motions having passed. No disease whatever existed beyond the impacted rectum and distended colon from atony of the bowel from old age. The masses were mechanically removed by means of the lithotomy scoop and enemata of oil, &c., and she lived four years, simply to die of old age.

Example.

Treatment.

In this form of constipation the value of nux vomica is well seen, a pill of half a grain of the extract with half a grain of belladonna, twice a week or oftener, giving tone to the intestine, and acting as a purge.

In women particularly, who have been in the habit of neglecting their bowels, and allowing the rectum to be a closed receptacle for fæculent matter, the cavity not only becomes much distended, but seems to lose the power of contracting and expelling its contents. I had, at Guy's, some years ago, a case well illustrating these points; for the rectum felt, on examination, like a loose bag, it was large enough to admit a fist, and was always full, having evidently lost all power of expulsion. This woman had, in young life, neglected herself, and in middle age could not get over the effects of such neglect. By daily enemata of cold water to wash out the bowel, and the subsequent injection of an astringent liquid, such as the decoction of bark and alum, with the daily use of a pill containing half a grain of extract of nux vomica, mixed with gentian, a complete recovery took place.

END OF VOL. I.

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